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Antarctic and Subantarctic echinoids from 'Marion Dufresne' expeditions MD03, MD04, MD08 and from the 'Polarstern' expedition Epos III

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Abstract. — The Subantarctic and Antarctic MD03, MD04, MD08 and Epos III expeditions collected regular and irregular echinoids from the continental shelf around Marion and Prince Edward islands (MD08), Crozet islands (MD03, MD08), Kerguelen islands (MD03, MD04), and the Weddell Sea (Epos III). The collection comprises 31 species belonging to 6 families. Affinities and taxonomic position of 18 species or subspecies are discussed : *Aporocidaris antarctica, Ctenocidaris nutrix nutrix, C. nutrix longispina, C. perrieri, C. speciosa, C. spinosa, Homalocidaris gigantea, Notocidaris mortenseni, N. gaussensis, Kamptosoma asterias, Sterechinus diadema, Plexechinus planus, P.* aff. *cinctus, Pourtalesia* aff. *hispida, Amphipneustes rostratus, Brachysternaster chesheri, Parapneustes abatoides* and *Delopatagus brucei.* Geographical and bathymetrical distributions for all species are investigated and tabulated.

Résumé. — Les échinides réguliers et irréguliers récoltés lors des expéditions subantarctiques et antarctiques MD03, MD04, MD08 et Epos III sont déterminés. Les récoltes ont été effectuées sur le plateau continental autour des îles Marion et Prince Edward (MD08), Crozet (MD03, MD08), Kerguelen (MD03, MD04), et dans la mer de Weddell (Epos III). La collection comprend 31 espèces appartenant à 6 familles. Les affinités et la position taxonomique de 18 espèces ou sous-espèces sont discutées : *Aporocidaris antarctica, Ctenocidaris nutrix nutrix, C. nutrix longispina, C. perrieri, C. speciosa, C, spinosa, Homalocidaris gigantea, Notocidaris mortenseni, N. gaussensis, Kamptosoma asterias, Sterechinus diadema, Plexechinus planus, P.* aff. *cinctus, Pourtalesia* aff. *hispida, Amphipneustes rostratus, Brachysternaster chesheri, Parapneustes abatoides* and *Delopatagus brucei.* Les distributions géographique et bathymétrique de toutes les espèces sont détaillées.

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Introduction

Bionomical investigations have been made in the Antarctic and Subantarctic regions by several recent expeditions (fig. 1). The MS "Marion-Dufresne" expeditions MD03, MD04, MD08, organized by the "Terres Australes et Antarctiques Françaises" (TAAF), investigated the continental shelf and slope of some Subantarctic islands, namely Kerguelen (MD03 and MD04 in 1974 and 1975, respectively), Crozet (MD03 and MD08 in 1974 and 1979, respectively), Marion and Prince Edward (MD08 in 1979). Two additional sets of data were obtained for Kerguelen (Golfe du Morbihan et Golfe des Baleiniers) by the "Japonaise"

collections Ker72 and Ker74. The MS "Polarstern" expedition Epos III studied the Weddell Sea. This last expedition was sponsored by the European Science Foundation and by the "Alfred Wegener Institüt" (AWI) for polar and marine research; the material was sorted by the "Centre National de Tri et d'Océanographie Biologique" (CENTOB, IFREMER). One of the aims of these expeditions was a quantitative and qualitative inventory of the benthos. Details of the program, stations, sampling methods and environmental (physical and chemical) conditions are given by HUREAU (1976) for MD03, by GUILLE (1977*a*) for MD04, Ker72 and Ker74, by ARNAUD and HUREAU (1979) for MD08, by ARNTZ *et al.* (1990) for Epos III. The study area is mapped in figure 1. The echinoid collections are deposited at the Muséum national d'Histoire naturelle in Paris.

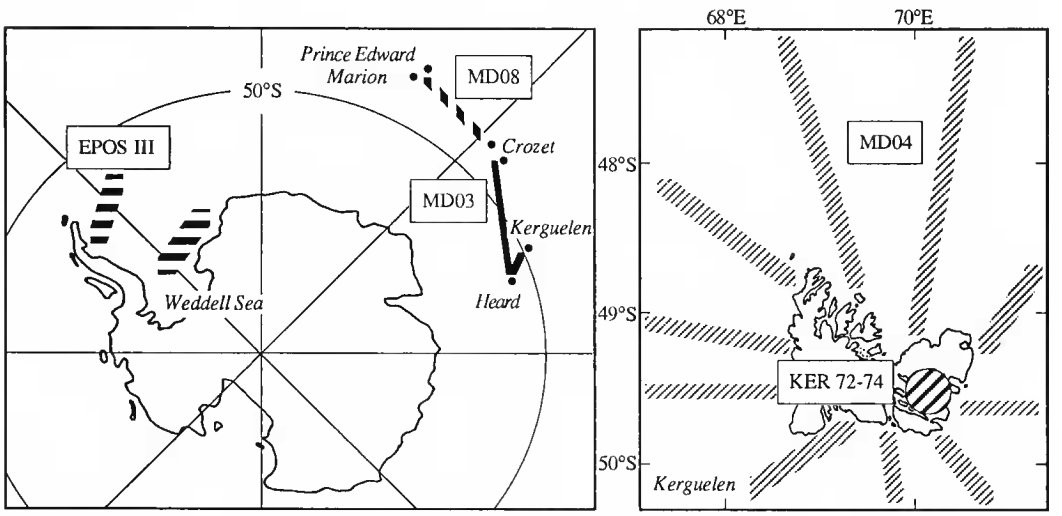

FIG. 1. — Areas prospected during the expeditions MD03, MD04, MD08, Ker72-74, and Epos III.

RESULTS

31 species of echinoids were collected in the Antarctic and Subantarctic regions during the MD03, MD04, MD08, "Japonaise" Ker72 and Ker74, and Epos III expeditions. They belong to 6 families : Cidaridae, Echinothuriidae, Echinidae, Urechinidae, Pourtalesiidae and Schizasteridae. The species and their collecting stations are listed for each expedition (see tables 1-5); their geographical (table 6) and bathymetric (fig. 5) distributions are also summarized. Species presenting taxonomic difficulties, or those rarely collected and in need of further description and illustration are discussed individually below. For the other species listed, please refer to MORTENSEN (1928*b*, 1935, 1943, 1950*b*, 1951) for more information. *Brachysternaster chesheri, Plexechinus planus* and *Urechinus mortenseni* were described subsequent to MORTENSEN's monograph, see LARRAIN (1985), MIRONOV (1978) and DAVID & MOOI (1990), respectively.

TABLE 1. — Inventories of the collected species and lists of stations of expedition MD03 at Kerguelen and Crozet islands (asterisks indicate that a part of the sample corresponds to broken specimens or fragments).

Station	Long.	Lat.	Depth	Number of specimens
		CIDARIDAE		
		Aporocidaris antarctica		
St. 13	65°39'9 E	50°49'1 S	3240 m	3
		Ctenocidaris nutrix nutrix		
St. 2	70°44'7 E	49°30'7 S	115 m	5
St. 2	70°47'1 E	49°33'2 S	130 m	5
St. 3	71°51'7 E	49°25'4 S	650-620 m	1
St. 7	75°38'4 E	52°12'7 S	560-525 m	38
St. 14	64°57'9 E	49°48'4 S	250 m	3
St. 14	64°50'6 E	49°45'8 S	262 m	1
St. 17	66°04'0 E	47°24'9 S	585 m	3
St. 22	70°51'1 E	48°58'5 S	105-90 m	34
St. 23	70°01'9 E	49°59'2 S	158 m	8
St. 24	69°48'7 E	50°10'7 S	195 m	56
		ECHINOTHURIIDAE		
		Kamptosoma asterias		
St. 12	69°35'7 E	55°49'5 S	4200-4225 m	8
		ECHINIDAE		
		Sterechinus neumayeri		
St. 2	70°47'1 E	49°33'2 S	130 m	67
St. 8	73°42'0 E	52°58'0 S	123 m	2
St. 14	64°57'9 E	49°48'4 S	250 m	4
St. 14	64°50'6 E	49°45'8 S	262 m	3
St. 18	68°07'1 E	47°42'2 S	243 m	5
St. 21	70°55'4 E	48°29'7 S	360-345 m	21*
St. 22	70°51'1 E	48°58'5 S	105-90 m	94*
St. 23	70°01'9 E	49°59'2 S	158 m	71
St. 24	69°48'7 E	50°10'7 S	195 m	19*
St. 26	51°59'0 E	46°24'0 S	180 m	10
St. 26	51°58'3 E	46°23'3 S	165 m	1
St. 28	51°29'0 E	46°18'1 S	400 m	5
St. 30	50°50'2 E	46°02'3 S	187 m	13
St. 31	50°32'8 E	45°57'2 S	110 m	5*
		URECHINIDAE		
		Plexechinus aff. **cinctus**		
St. 17	66°04'0 E	47°24'9 S	585 m	1*

		POURTALESIIDAE		
		Pourtalesia cf. hispida		
St. 12	69°35'7 E	55°49'5 S	4200-4225 m	1*
St. 13	65°39'9 E	50°49'1 S	3240 m	6*
		SCHIZASTERIDAE		
		Abatus cordatus		
St. 7	75°38'4 E	52°12'7 S	560-525 m	4
St. 8	73°42'0 E	52°58'0 S	123 m	8
St. 8	73°38'0 E	52°59'4 S	90 m	5
St. 10	72°50'1 E	53°06'7 S	255 m	1*
St. 17	66°04'0 E	47°24'9 S	585 m	1*
		Brisaster kerguelensis		
St. 3	71°51'7 E	49°25'4 S	650-620 m	16*
St. 6	71°35'8 E	50°37'9 S	565 m	1*
St. 7	75°38'4 E	52°12'7 S	560-525 m	1*
St. 17	66°04'0 E	47°24'9 S	585 m	1*
St. 18	68°07'1 E	47°42'2 S	243 m	1

TABLE 2. — Inventories of the collected species and lists of stations of expedition MD04 at Kerguelen islands (the precise depths of stations 105 to 107 are unknown).

Station	Long.	Lat.	Depth	Number of specimens
		CIDARIDAE		
		Ctenocidaris nutrix nutrix		
St. 2	70°22'2 E	49°29'3 S	44 m	7*
St. 3	70°33'2 E	49°28'8 S	75 m	7
St. 4	70°40'5 E	49°29'8 S	96 m	4
St. 5	70°56'0 E	49°30'0 S	147 m	4*
St. 5	70°54'5 E	49°30'6 S	140 m	2
St. 7	70°57'0 E	49°32'1 S	149-155 m	19
St. 14	69°44'6 E	49°44'4 S	103 m	2
St. 15	69°47'2 E	49°54'8 S	120 m	3
St. 16	69°49'2 E	50°02'7 S	166 m	3
St. 21	69°18'3 E	49°41'4 S	110 m	1*
St. 23	68°48'5 E	49°55'5 S	155 m	1
St. 24	68°29'0 E	50°04'0 S	195 m	9*
St. 25	68°17'2 E	50°08'8 S	255 m	6
St. 26	68°28'3 E	50°03'4 S	192-198 m	3*
St. 26	68°25'0 E	50°05'8 S	207 m	50*
St. 34	68°10'7 E	49°27'4 S	185 m	1
St. 35	67°53'1 E	49°28'0 S	191 m	1
St. 37	67°19'9 E	49°26'5 S	301 m	1
St. 44	68°03'5 E	49°04'0 S	175-192 m	6
St. 45	67°30'4 E	49°00'3 S	206 m	2

St. 47	67°07'9 E	48°59'1 S	315 m	8*
St. 51	68°45'1 E	48°44'0 S	95 m	2
St. 52	68°31'2 E	48°37'2 S	125 m	4
St. 57	67°32'5 E	48°07'0 S	365 m	1
St. 65	69°04'0 E	48°01'0 S	177 m	1
St. 101	70°45'6 E	49°03'4 S	84 m	1
St. 102	70°50'8 E	48°56'6 S	95 m	2
St. 108	70°41'3 E	49°03'4 S	76 m	1
St. 113	70°19'8 E	49°51'0 S	145 m	rad.
St. 114	70°24'4 E	49°54'5 S	168 m	5*
St. 116	70°34'6 E	50°02'0 S	346 m	1
St. 118	70°28'7 E	49°58'6 S	245-185 m	22
St. 119	70°19'0 E	49°49'9 S	131 m	1

ECHINIDAE

Sterechinus neumayeri

St. 3	70°33'2 E	49°28'8 S	75 m	2
St. 5	70°54'5 E	49°30'6 S	140 m	4
St. 8	69°38'3 E	49°31'2 S	21 m	2
St. 8	69°38'3 E	49°31'2 S	22 m	3
St. 9	69°39'4 E	49°32'2 S	110 m	2
St. 10	69°40'8 E	49°33'2 S	49 m	7
St. 14	69°44'6 E	49°44'4 S	103 m	7
St. 15	69°47'2 E	49°54'8 S	120 m	6
St. 23	68°48'5 E	49°55'5 S	155 m	2
St. 24	68°29'0 E	50°04'0 S	195 m	3*
St. 26	68°25'0 E	50°05'8 S	207 m	37*
St. 27	69°14'0 E	49°32'9 S	176-170 m	10
St. 47	67°07'9 E	48°59'1 S	315 m	2
St. 48	67°17'6 E	49°00'4 S	239 m	2*
St. 52	68°31'2 E	48°37'2 S	125 m	4
St. 59	68°38'6 E	48°41'4 S	104 m	3
St. 62	69°11'6 E	48°40'1 S	75 m	2
St. 62	69°11'3 E	48°40'6 S	61 m	1
St. 70	68°56'5 E	47°42'2 S	204 m	3
St. 72	69°12'0 E	48°46'6 S	57 m	5
St. 74	69°01'1 E	49°02'3 S	30 m	3
St. 75	69°08'0 E	48°58'1 S	211 m	1
St. 76	69°08'0 E	48°54'6 S	125-89 m	10
St. 77	69°10'5 E	48°51'3 S	190 m	3
St. 78	69°12'3 E	48°45'7 S	46-54 m	3
St. 79	69°21'3 E	49°04'0 S	37 m	6
St. 84	69°56'5 E	49°08'3 S	50 m	1
St. 88	69°59'3 E	48°54'6 S	87 m	5
St. 90	70°09'0 E	48°20'9 S	128 m	1*
St. 91	70°14'0 E	48°02'0 S	151 m	1
St. 93	70°15'7 E	47°44'8 S	164-162 m	10
St. 108	70°41'3 E	49°03'4 S	76 m	31
St. 113	70°21'2 E	49°50'2 S	147 m	3
St. 113	70°19'8 E	49°51'0 S	145 m	frag.
St. 114	70°24'4 E	49°54'5 S	168 m	2
St. 118	70°28'7 E	49°58'6 S	245-185 m	14
St. 119	70°19'0 E	49°49'9 S	131 m	4

POURTALESIIDAE

Pourtalesia sp.

St. 26	68°25′0 E	50°05′8 S	207 m	2
St. 57	67°32′5 E	48°07′0 S	365 m	frag.

SCHIZASTERIDAE

Abatus cordatus

St. 5	70°54′ 5 E	49°30′6 S	140 m	1
St. 8	69°38′3 E	49°31′2 S	21 m	4*
St. 8	69°38′3 E	49°31′2 S	22 m	4
St. 9	69°39′4 E	49°32′2 S	110 m	1
St. 10	69°40′8 E	49°33′2 S	58 m	1
St. 10	69°40′8 E	49°33′2 S	49 m	1
St. 12	69°40′3 E	49°39′8 S	36 m	4
St. 13	69°43′3 E	49°41′3 S	72 m	2
St. 18	69°20′4 E	49°35′4 S	21 m	22*
St. 18	69°20′5 E	49°35′2 S	18 m	4*
St. 18	69°20′5 E	49°35′2 S	19 m	1
St. 19	69°20′5 E	49°36′0 S	67 m	14*
St. 19	69°20′7 E	49°36′1 S	70 m	1*
St. 23	68°48′5 E	49°55′5 S	155 m	1
St. 30	68°50′1 E	49°27′7 S	35 m	1
St. 31	68°46′8 E	49°27′4 S	63 m	15*
St. 31	68°46′5 E	49°27′3 S	68 m	1
St. 42	68°47′5 E	49°09′3 S	140 m	1
St. 49	68°52′2 E	48°48′4 S	60 m	3
St. 49	68°52′2 E	48°48′2 S	65 m	2*
St. 52	68°31′2 E	48°37′2 S	125 m	1
St. 54	67°53′1 E	48°19′7 S	185 m	1
St. 60	69°02′2 E	48°41′0 S	18 m	5*
St. 60	69°02′2 E	48°41′0 S	17 m	10*
St. 61	69°03′5 E	48°40′5 S	51 m	2
St. 61	69°03′5 E	48°40′4 S	48 m	1
St. 73	69°04′0 E	49°06′3 S	35 m	15
St. 73	69°04′0 E	49°06′3 S	30 m	11
St. 74	69°01′1 E	49°02′3 S	31 m	3
St. 74	69°01′1 E	49°02′3 S	30 m	1
St. 76	69°08′0 E	48°54′6 S	125-89 m	1
St. 79	69°21′3 E	49°04′0 S	43 m	2*
St. 79	69°21′3 E	49°04′0 S	37 m	1
St. 82	69°31′1 E	48°55′4 S	209-305 m	3
St. 83	69°55′6 E	49°10′9 S	24 m	73*
St. 86	69°58′0 E	49°02′9 S	95 m	4*
St. 90	70°09′0 E	48°20′9 S	128 m	1
St. 100	70°40′5 E	49°03′6 S	74 m	1
St. 110	70°34′0 E	49°10′0 S	18 m	17*
St. 110	70°34′0 E	49°10′0 S	22 m	38*
St. 113	70°19′8 E	49°51′0 S	145 m	frag.
St. 121	70°08′1 E	49°41′8 S	16-17 m	17

		Brisaster kerguelensis		
St. 26	68°25'0 E	50°05'8 S	207 m	9
St. 66	68°58'5 E	47°41'5 S	200 m	5
St. 70	68°56'5 E	47°42'2 S	204 m	1
St. 76	69°08'0 E	48°54'6 S	125-89 m	1
St. 89	70°04'7 E	48°38'1 S	105 m	1
St. 89	70°06'0 E	48°38'0 S	105 m	2
St. 90	70°09'0 E	48°19'3 S	128 m	1
St. 92	70°15'7 E	47°44'8 S	164 m	2
St. 92	70°15'8 E	47°44'9 S	164 m	1*
St. 93	70°15'7 E	47°44'8 S	164-162 m	2
St. 94	70°23'8 E	47°26'5 S	170 m	33*
St. 95	70°27'5 E	47°09'7 S	188 m	2*
St. 98	70°30'2 E	46°47'7 S	1218 m	4
St. 105	71°06'5 E	48°43'9 S	.....?	frag.
St. 106	71°06'5 E	48°43'5 S	.....?	13
St. 107	71°18'5 E	48°32'3 S	.....?	frag.
St. 115	70°29'1 E	49°58'0 S	234 m	2

TABLE 3. — Inventories of the collected species and lists of stations of expedition MD08 at Marion, Prince Edward and Crozet islands.

Station	Long.	Lat.	Depth	Number of specimens
		ECHINIDAE		
		Sterechinus neumayeri		
St. 9	51°50'5 E	46°22'8 S	75-104 m	1
St. 9	51°49'6 E	46°10'8 S	120-150 m	6
St. 9	51°54'3 E	46°22'4 S	150-160 m	7
St. 9	51°52'3 E	46°19'8 S	150-340 m	13
St. 11	37°53'9 E	46°52'2 S	115-120 m	2
St. 12	37°54'1 E	46°55'7 S	103 m	73
St. 13	37°55'6 E	46°56'3 S	120 m	88
St. 15	38°00'0 E	46°57'7 S	185-210 m	52
St. 15	37°59'9 E	46°57'7 S	204 m	9
St. 16	37°59'1 E	46°50'2 S	138-142 m	18
St. 17	37°53'8 E	46°52'1 S	112 m	4
St. 17	37°53'5 E	46°52'5 S	110 m	3
St. 18	37°56'2 E	46°49'8 S	140 m	34
St. 18	37°56'4 E	46°49'8 S	138 m	4
St. 19	38°03'7 E	46°45'9 S	190 m	9
St. 20	38°03'5 E	46°47'2 S	180 m	17
St. 21	37°52'9 E	46°52'9 S	50 m	2
St. 21	37°52'8 E	46°53'3 S	50 m	5
St. 22	37°51'9 E	46°52'4 S	31 m	5
St. 23	38°01'3 E	46°57'9 S	250-460 m	1
St. 25	37°56'6 E	46°45'3 S	185-232 m	121
St. 26	38°00'6 E	46°50'6 S	135-145 m	41
St. 28	37°57'2 E	46°43'5 S	246-285 m	3

St. 31	37°46'6 E	46°59'5 S	185 m	2
St. 32	37°46'8 E	46°59'0 S	83-100 m	9
St. 33	37°51'5 E	46°52'2 S	45 m	1
St. 34	37°51'2 E	46°50'2 S	115 m	33
St. 34	37°51'2 E	46°50'2 S	110 m	10
St. 35	38°00'3 E	46°39'7 S	53 m	8
St. 36	38°06'7 E	46°40'7 S	570-315 m	4
St. 36	38°07'2 E	46°40'9 S	570-375 m	2
St. 42	51°34'9 E	46°21'4 S	172-220 m	45
St. 48	50°37'1 E	46°05'0 S	200-140 m	23
St. 50	50°37'8 E	45°51'5 S	150 m	1
St. 53	50°20'6 E	46°07'5 S	110 m	1
St. 66	49°13'3 E	46°15'3 S	500-562 m	1*
St. 72	50°32'0 E	46°23'4 S	187-155 m	2
St. 73	50°37'8 E	46°24'3 S	263-412 m	10
St. 74	50°47'8 E	46°17'8 S	290 m	4
St. 75	51°52'9 E	46°19'9 S	155-257 m	15
St. 75	51°52'0 E	46°21'0 S	145-135 m	2
St. 78	51°58'1 E	46°23'7 S	142-170 m	3
St. 79	51°53'8 E	46°24'6 S	100 m	3

SCHIZASTERIDAE

Brisaster kerguelensis

St. 9	51°51'2 E	46°22'9 S	125 m	1*
St. 40	51°33'9 E	46°21'1 S	190 m	1*
St. 43	51°11'0 E	46°18'5 S	1400-1500 m	13*
St. 44	51°14'0 E	46°18'0 S	1500 m	1*
St. 46	50°44'7 E	46°10'6 S	375-390 m	10*
St. 57	50°05'3 E	45°46'2 S	195-200 m	2*
St. 59	49°59'3 E	45°59'9 S	210-217 m	2*
St. 60	49°48'2 E	46°02'7 S	245-250 m	2
St. 67	49°37'4 E	46°16'8 S	277-280 m	1
St. 70	50°28'4 E	46°46'6 S	1350-1440 m	7*
St. 71	50°39'0 E	46°37'5 S	268-270 m	2*
St. 72	50°32'0 E	46°23'4 S	187-155 m	8*

Tripylaster philippi

St. 18	37°56'2 E	46°49'8 S	140 m	2*
St. 28	37°58'4 E	46°42'6 S	257-280 m	1*
St. 31	37°46'6 E	46°59'5 S	185 m	1*

TABLE 4. — Inventories of the collected species and lists of stations of expeditions "Japonaise" 1972 & 1974 at Kerguelen islands.

Station	Depth	Number of specimens
CIDARIDAE		
Ctenocidaris nutrix nutrix		
Golfe du Morbihan (7 stations)	23-270 m	13*
ECHINIDAE		
Sterechinus neumayeri		
Off Ratmanoff (1 station)	250-270 m	4
Golfe du Morbihan (1 station)	46 m	1
Golfe des Baleiniers (2 stations)	34-38 m	2*
SCHIZASTERIDAE		
Abatus cordatus		
Golfe du Morbihan (82 stations)	6-175 m	94*
Golfe des Baleiniers (14 stations)	1-50 m	45*

TABLE 5. — Inventories of the collected species and lists of stations of expedition Epos III in the Weddell Sea.

Station	Long.	Lat.	Depth	Number of specimens
CIDARIDAE				
Ctenocidaris nutrix longispina				
St. 229	26°16'7 W	75°15'7 S	498 m	1
St. 235	27°34'7 W	75°09'1 S	404-407 m	2
St. 241	28°00'3 W	75°02'9 S	451-453 m	6
St. 256	27°36'4 W	75°10'9 S	399-382 m	1
St. 257	27°59'1 W	75°08'2 S	460-457 m	1
St. 270	20°45'1 W	73°21'3 S	294-305 m	3
St. 275	12°34'7 W	71°39'5 S	301-330 m	1
Ctenocidaris perrieri				
St. 217	46°58'1 W	60°37'6 S	232-239 m	2
St. 224	13°04'2 W	71°15'8 S	185-187 m	7
St. 229	26°13'3 W	74°14'8 S	500-506 m	2
St. 248	29°31'3 W	74°39'9 S	593-602 m	2
St. 271	20°59'4 W	73°17'0 S	352-399 m	1
St. 273	21°03'9 W	73°34'8 S	193-197 m	3
St. 275	12°34'7 W	71°39'5 S	301-330 m	3
St. 284	13°14'0 W	71°12'0 S	402-412 m	1

Ctenocidaris cf. **rugosa**

St. 217	46°58′1 W	60°37′6 S	232-239 m	1
St. 250	29°39′9 W	74°35′1 S	799-810 m	1

Ctenocidaris speciosa

St. 217	46°58′1 W	60°37′6 S	232-239 m	1
St. 226	25°58′3 W	75°15′9 S	569-574 m	1
St. 229	26°16′7 W	75°15′7 S	498 m	1
St. 248	29°31′3 W	74°39′9 S	593-602 m	8
St. 249	29°38′2 W	74°37′4 S	701-708 m	5
St. 250	29°39′9 W	74°35′1 S	799-810 m	2
St. 261	29°35′5 W	74°36′5 S	798-810 m	15*
St. 269	19°49′4 W	72°54′7 S	602-617 m	3

Ctenocidaris spinosa

St. 274	12°09′4 W	71°38′8 S	196-212 m	1
St. 275	12°34′7 W	71°39′5 S	301-330 m	5
St. 281	12°21′1 W	71°39′0 S	389-423 m	1

Ctenocidaris sp.

St. 217	46°58′1 W	60°37′6 S	232-239 m	2
St. 258	29°36′6 W	74°40′2 S	484-509 m	1

Homalocidaris gigantea

St. 217	46°58′1 W	60°37′6 S	232-239 m	2
St. 235	27°34′7 W	75°09′1 S	404-407 m	1
St. 258	29°36′6 W	74°40′2 S	484-509 m	4
St. 271	20°59′4 W	73°17′0 S	352-399 m	3
St. 270	20°45′1 W	73°21′3 S	294-305 m	1
St. 275	12°34′7 W	71°39′5 S	301-330 m	1
St. 291	12°33′5 W	71°06′1 S	499-515 m	3

Homalocidaris cf. **gigantea**

St. 248	29°31′3 W	74°39′9 S	593-602 m	1*

Notocidaris gaussensis

St. 252	29°41′9 W	74°28′2 S	1153-1223 m	1

Notocidaris mortenseni

St. 226	25°53′5 W	75°17′1 S	593-624 m	1
St. 226	25°58′3 W	75°15′9 S	569-574 m	4
St. 248	29°31′3 W	74°39′9 S	593-602 m	8
St. 249	29°42′5 W	74°36′2 S	699-712 m	2
St. 290	12°34′0 W	71°05′9 S	522-531 m	2
St. 291	12°33′5 W	71°06′1 S	499-515 m	6

ECHINIDAE

Sterechinus agassizi

St. 312	00°06′3 W	54°43′9 S	471-320 m	3

Sterechinus antarcticus

St. 217	46°58′1 W	60°37′6 S	232-239 m	1
St. 224	13°04′2 W	71°15′8 S	185-187 m	1*

St. 226	25°58′3 W	75°15′9 S	569-574 m	18
St. 229	26°12′5 W	75°14′9 S	500-509 m	4
St. 229	26°16′7 W	75°15′7 S	498 m	7
St. 230	26°59′4 W	75°14′2 S	270-280 m	12
St. 230	26°38′9 W	75°14′5 S	275-279 m	3
St. 235	27°34′7 W	75°09′1 S	404-407 m	3
St. 241	27°59′5 W	75°07′1 S	457-462 m	6
St. 241	28°00′3 W	75°02′9 S	451-453 m	10
St. 245	29°41′6 W	74°39′7 S	483-484 m	3
St. 249	29°42′5 W	74°36′2 S	699-712 m	53
St. 249	29°38′2 W	74°37′4 S	701-708 m	23
St. 250	29°39′9 W	74°35′1 S	799-810 m	23
St. 250	29°35′6 W	74°36′3 S	794-805 m	61
St. 252	29°41′9 W	74°28′2 S	1153-1223 m	26
St. 253	29°41′4 W	74°09′5 S	1996-2012 m	33
St. 256	27°36′4 W	75°10′9 S	382-399 m	1*
St. 258	29°36′6 W	74°40′2 S	484-509 m	10
St. 259	29°16′8 W	74°40′2 S	587-611 m	1
St. 261	29°35′5 W	74°36′5 S	798-810 m	23
St. 269	19°49′4 W	72°54′7 S	602-617 m	8
St. 270	20°45′1 W	73°21′3 S	294-305 m	28
St. 272	21°33′6 W	73°26′9 S	406-409 m	3
St. 273	21°03′9 W	73°34′8 S	193-197 m	261
St. 274	12°09′4 W	71°38′8 S	196-212 m	19
St. 275	12°34′7 W	71°39′5 S	301-330 m	22
St. 281	12°21′1 W	71°39′5 S	402-450 m	19
St. 282	12°27′4 W	71°31′7 S	609-575 m	2
St. 284	13°14′0 W	71°12′0 S	402-412 m	13
St. 289	13°27′9 W	71°12′0 S	672-677 m	40
St. 290	12°34′0 W	71°05′9 S	522-531 m	17
St. 291	12°33′5 W	71°06′2 S	499-515 m	42
St. 293	12°53′8 W	71°06′2 S	771-793 m	65

URECHINIDAE

Plexechinus nordenskjoldi

St. 217	46°56′1 W	60°37′6 S	232-239 m	33
St. 252	29°41′9 W	74°28′2 S	1153-1223 m	29
St. 261	29°35′5 W	74°36′5 S	798-810 m	2
St. 289	13°27′9 W	71°12′0 S	672-677 m	1
St. 291	12°33′5 W	71°06′2 S	499-515 m	1

Plexechinus planus

St. 252	29°41′9 W	74°28′2 S	1153-1223 m	19
St. 295	13°48′1 W	71°08′8 S	2037-2025 m	3

Urechinus mortenseni

St. 249	29°38′2 W	74°37′4 S	701-708 m	1
St. 252	29°41′9 W	74°28′2 S	1153-1223 m	2

Urechinus wyvilli

St. 253	29°41′4 W	74°09′5 S	1996-2012 m	10
St. 295	13°48′1 W	71°08′8 S	2037-2025 m	2

POURTALESIIDAE

Pourtalesia aff. hispida

St. 252	29°41'9 W	74°28'2 S	1153-1223 m	7

SCHIZASTERIDAE

Abatus cavernosus

St. 217	46°56'1 W	60°37'6 S	232-239 m	1

Amphipneustes bifidus

St. 258	29°36'6 W	74°40'2 S	484-509 m	1
St. 272	21°33'6 W	73°26'9 S	406-409 m	2
St. 275	12°34'7 W	71°39'5 S	301-330 m	1
St. 281	12°21'1 W	71°39'5 S	402-450 m	1
St. 284	13°14'0 W	71°12'0 S	402-412 m	1
St. 290	12°34'0 W	71°05'9 S	522-531 m	1

Amphipneustes lorioli

St. 211	55°20'1 W	60°59'8 S	182-213 m	1
St. 217	46°56'1 W	60°37'6 S	232-239 m	12*
St. 235	27°33'2 W	75°08'9 S	399-404 m	1
St. 235	27°34'7 W	75°09'1 S	404-407 m	8
St. 241	28°00'3 W	75°02'9 S	451-453 m	4
St. 250	29°39'9 W	74°35'1 S	799-810 m	3
St. 253	29°41'4 W	74°09'5 S	1996-2012 m	1
St. 256	27°36'4 W	75°10'9 S	382-399 m	4*
St. 261	29°35'5 W	74°36'5 S	798-810 m	10
St. 273	21°03'9 W	73°34'8 S	193-197 m	1

Amphipneustes rostratus

St. 235	27°34'7 W	75°09'1 S	404-407 m	1
St. 248	29°31'3 W	74°39'9 S	593-602 m	3
St. 249	29°42'5 W	74°36'2 S	699-712 m	1
St. 249	29°38'2 W	74°37'4 S	701-708 m	2
St. 250	29°39'9 W	74°35'1 S	799-810 m	12
St. 252	29°41'9 W	74°28'2 S	1153-1223 m	11
St. 261	29°35'5 W	74°36'5 S	798-810 m	35
St. 272	21°33'6 W	73°26'9 S	406-409 m	2
St. 290	12°34'0 W	71°05'9 S	522-531 m	1

Amphipneustes similis

St. 211	55°20'1 W	60°59'8 S	182-213 m	3
St. 217	46°56'1 W	60°37'6 S	232-239 m	1
St. 235	27°34'7 W	75°09'1 S	404-407 m	5
St. 241	27°59'5 W	75°07'1 S	457-462 m	1

Brachysternaster chesheri

St. 217	46°56'1 W	60°37'6 S	232-239 m	2*
St. 235	27°34'7 W	75°09'1 S	404-407 m	4
St. 241	28°00'3 W	75°02'9 S	451-453 m	2
St. 250	29°35'6 W	74°36'3 S	794-805 m	1
St. 252	29°41'9 W	74°28'2 S	1153-1223 m	19
St. 256	27°36'4 W	75°10'9 S	382-399 m	1
St. 261	29°35'5 W	74°36'5 S	798-810 m	37

		Delopatagus brucei		
St. 253	29°41'4 W	74°09'5 S	1996-2012 m	2
		Parapneustes abatoides		
St. 211	55°20'1 W	60°59'8 S	182-213 m	1
St. 217	46°56'1 W	60°37'6 S	232-239 m	2
St. 248	29°31'3 W	74°39'9 S	593-602 m	3
St. 249	29°38'2 W	74°37'4 S	701-708 m	1
St. 250	29°39'9 W	74°35'1 S	799-810 m	16
St. 250	29°35'6 W	74°36'3 S	794-805 m	1
St. 261	29°35'5 W	74°36'5 S	798-810 m	8

Taxonomic comments

The affinities and taxonomic position of 18 species or subspecies : *Aporocidaris antarctica, Ctenocidaris nutrix nutrix, C. nutrix longispina, C. perrieri, C. speciosa, C. spinosa, Homalocidaris gigantea, Notocidaris mortenseni, N. gaussensis, Kamptosoma asterias, Sterechinus diadema, Plexechinus planus, P.* aff. *cinctus, Pourtalesia* aff. *hispida, Amphipneustes rostratus, Brachysternaster chesheri, Parapneustes abatoides* and *Delopatagus brucei* are discussed.

Aporocidaris antarctica Mortensen, 1909

Aporocidaris antarctica Mortensen, 1909 : 25, pl. 3 figs 5-7, pl. 5 figs 2, 9-11, pl. 7 figs 4-5, pl. 10 figs 6, 9, pl. 11 figs 10, pl. 13 figs 3, 6, pl. 14 figs 1, 16, 17, pl. 15 figs 8, 12-13, 16, 24-28, pl. 16 fig. 15; Mortensen, 1928*b* : 116.

This species was known only from the 12 specimens collected by the ' Deutsche Südpolar Expedition ' at 2725-3486 m depth (Mortensen, 1909) and supposedly by some other material from previous collections (Mortensen, 1928*b*). The specimens from the MD03 expedition extend the known geographical distribution of this species, for they were collected in the same quadrant of the Antarctic Sea, but far to the north, close to the Antarctic convergence. Work in progress (A.L.) on this species shows that its systematic status is precarious.

CTENOCIDARIS Mortensen, 1910

This genus comprises 7 species which appear closely related to each other. They differ mainly in the shape and ornamentation of the oral primary spines, in the length and ornamentation of the coronal primary spines, and, in some species, in the arrangement of the apical plates (Mortensen, 1928*b*). Differences and similarities between *C. nutrix nutrix* and *C. nutrix longispina*, as well as between *C. perrieri, C. speciosa* and *C. spinosa* are discussed below.

Ctenocidaris nutrix nutrix (Wyville Thomson, 1876)

Cidaris nutrix Wyville Thomson, 1876 : 62.
Stereocidaris nutrix; MORTENSEN, 1903 : 25, 29, 173, pl. 10 figs 3-4, 12, 14, 24.
Eurocidaris nutrix; MORTENSEN, 1909 : 30, pl. 3 fig. 9, pl. 4 figs 5-6, pl. 6 figs 2, 4-9, 11-12, pl. 10 figs 7, 11, pl. 11 fig. 12, pl. 13 fig. 7, pl. 15 figs 17, 20-23.
Ctenocidaris (*Eurocidaris*) *nutrix*; MORTENSEN, 1928*b* : 128.

Ctenocidaris nutrix longispina (Mortensen, 1928*a*)
(Pl. I, 1-3)

Eurocidaris nutrix var. *longispina* Mortensen, 1928*a* : 67.
Ctenocidaris (*Eurocidaris*) *nutrix* var. *longispina*; MORTENSEN, 1928*b* : 129, pl. 57 fig. 8.

The original diagnostic character (length of the primary coronal spines) for these two subspecies is unreliable. Later, MORTENSEN (1928*b*) found differences in the position of the ocular plates (all insert in *C. nutrix longispina*, while they are usually exsert in *C. nutrix nutrix*). Our identification of the specimens from Epos III is based on this latter characteristic (pl. I, 2). However, the distinction between the two subspecies is weakly grounded (as already noticed by CLARK, 1925), and it may be necessary to reconsider their status.

Ctenocidaris perrieri Kœhler, 1912*a*
(Pl. II, 1-3)

Ctenocidaris perrieri Kœhler, 1912*a* : 161; KŒHLER, 1912*b* : 150, pl. 12 figs 4-8, pl. 13 figs 2-8, pl. 14 figs 9-14, pl. 15 figs 1-10; MORTENSEN, 1928*b* : 123, pl. 69 fig. 23

Ctenocidaris speciosa Mortensen, 1910
(Pl. III, 1-3)

Ctenocidaris speciosa Mortensen, 1910 : 4, pls 1-2, pl. 3 figs 1-3, pl. 8; MORTENSEN, 1928*b* : 122.

Ctenocidaris spinosa (Kœhler, 1926)
(Pl. IV, 1-2)

Notocidaris spinosa Kœhler, 1926 : 14, pl. 97 figs 1-6, pl. 98 figs 1-7, pl. 99 figs 1-3, pl. 112 fig. 7, pl. 114 fig. 7, pl. 119 fig. 6.
Ctenocidaris spinosa; MORTENSEN, 1928*b* : 124, pl. 12 fig. 13, pl. 77 figs 10-12.

C. spinosa was previously known only from the 'Aurora' specimens. MORTENSEN (1928*b*) stated that *C. perrieri* is probably the nearest related to *C. speciosa* and that both are very close to *C. spinosa*. We distinguish these three species on the basis of size and spinulation of the coronal primary spines, the shape and ornamentation of the oral primary spines, the

tuberculation close to the median interradial suture, and the color of the test. *C. spinosa* possesses densely and strongly thorny primary coronal spines (pl. IV, 1); denticules are sharp, arranged in ca. 8 longitudinal series that may fuse into ridges. Oral primaries are spear-shaped and bear sharp, lined spinules, these spinules sometimes fused into two lateral wings (pl. IV, 2). A supplementary character, not mentioned by MORTENSEN (1928*b*), is noted : there is a conspicuous naked area on both sides of the interradial suture. The color is typically brownish purple. *C. perrieri* differs from *C. spinosa* in having slender coronal primaries which show a less regular arrangement of their spinules (lack of ridges), blunter spinules on the oral primaries (pl. II, 3), tuberculation which reaches the interradial suture (lack of naked areas), and a yellowish color. *C. speciosa* has finely serrated coronal primaries (pl. III, 1-2), flattened oral primaries bearing blunt, coarse spinules (pl. III, 3). The median interradial area and the color of the specimens are similar to those of *C. perrieri.*

Homalocidaris gigantea (Clark, 1925)
(Pl. IV, 3-4)

Austrocidaris gigantea Clark, 1925 : 28, pl. 3 figs 1-2.
Homalocidaris gigantea; MORTENSEN, 1928*b* : 137, pl. 11 fig. 6, pl. 77 fig. 14, pl. 83 fig. 23; MORTENSEN, 1950*a* : 297, pl. 7 figs 4-6.

This species was only known by two specimens sampled by the 'Discovery' near Victoria Land in the Ross Sea at 180 m depth (CLARK, 1925) and by two specimens sampled by the BANZAR expedition in the Bellingshausen Sea off Palmer Archipelago (MORTENSEN, 1950*a*). The third record corresponds to the 15 specimens collected during the Epos III expedition in the Weddell Sea. These specimens fit closely the description given by CLARK (1925) and completed by MORTENSEN (1928*b*). Their simultaneous occurrence in two distinct quadrants indicate that the distribution of the species is probably circum-Antarctic.

NOTOCIDARIS Mortensen, 1909

Notocidaris mortenseni (Kœhler, 1900)

Goniocidaris mortenseni Kœhler, 1900 : 816; KŒHLER, 1901 : 5, pl. 1 fig. 1 pl. 2, fig. 11, pl. 3 fig. 17, pl. 4 fig. 29, pl. 5 fig. 30.
Stereocidaris mortenseni; MORTENSEN, 1903 : 27, 29, pl. 8 fig. 34.
Notocidaris mortensi; MORTENSEN, 1909 : 21, pl. 3 figs 1, 8, 10, pl. 14 figs 3, 6; MORTENSEN, 1928*b* : 131, pl. 11 figs 13-15, pl. 68 fig. 15.

Notocidaris gaussensis Mortensen, 1909
(Pl. V, 1-2)

Notocidaris gaussensis Mortensen, 1909 : 18, pl. 1, pl. 2 figs 1-2, pl. 5 figs 13-16, 19-21, pl. 7 fig. 2, pl. 10 figs 5, 8, pl. 11 fig. 3, pl. 13 fig. 1, pl. 14 figs 2, 4, 10, 15, pl. 15 fig. 10, pl. 18 figs 9-11, 14, 17-18; MORTENSEN, 1928*b* : 134.

The features of the upper primary spines given by MORTENSEN (1928*b*) to separate *N. mortenseni* from *N. gaussensis* are confusing because the ornamentation of these spines varies. These species differ markedly in their upper and oral primaries. *N. gaussensis* has wingless upper primaries that are usually smooth all along the shaft and sometimes distally flattened (pl. V, 1). Oral primaries are spear-shaped, slightly curved, and smooth (pl. V, 2). *N. mortenseni* has upper primaries bearing large, coarse spinules that may fuse together into wing-like extensions. Oral primaries are keeled (two opposite keels), triangularly spear-shaped, straight, and serrated at their basis. Some variations exist; one *N. mortenseni* (among the 8 specimens of station 248) has simple upper primaries and gently curved oral primaries, widened centrally, and more or less diamond shaped.

Kamptosoma asterias (A. Agassiz, 1881)

Phormosoma asterias A. Agassiz, 1881 : 104, pl. 12a figs 7-9.
Kamptosoma asterias; MORTENSEN, 1903 : 60, 177, pl. 11 fig. 18, pl. 12 figs 12, 32, pl. 13 figs 9, 15, 21, pl. 14 fig. 29; MORTENSEN, 1935; 157, pl. 3 figs 5-8, pl. 76 figs 17-19.

Eight specimens were collected during the MD03 expedition. They constitute the second record of this deep-sea species, and extend its geographical distribution to the South Indian Ocean. The 'Challenger' material originated from the Central Pacific Ocean, and off the coast of Chile.

Sterechinus diadema (Studer, 1876)

Echinus diadema Studer, 1876 : 456.
Sterechinus margaritaceus; MORTENSEN, 1903 : 101, 105, 177, pl. 19 figs 3, 20, 33.
Sterechinus diadema; DÖDERLEIN, 1903-1906 : 219, 225, pl. 27 fig. 5, pl. 35 fig. 1, pl. 47 figs 8, 10c; MORTENSEN, 1943 : 102, pl. 13 figs 3-4, pl. 19 figs 1-5, pl. 20 figs 4-5, pl. 56 figs 1-3.

S. diadema was dredged during the MD03, MD04, MD08 and 'Japonaise' expeditions around Marion, Crozet, Kerguelen and Heard islands. The specimens were identified on the basis of the diagnostic features given by MORTENSEN (1943). Mots of these features, observed in our specimens, vary in the direction of *S. neumayeri*. The general shape of the test varies from subconical to regularly hemispherical; the color of the cleaned test varies from whitish to brownish; the tube feet spicules are numerous or scarse; the outer corners of the valves of the globiferous pedicellariae may be produced. The question, whether *S. neumayeri* is really a distinct species from *S. diadema*, has been debated by CLARK (1925) and MORTENSEN (1943). CLARK (1925) considered them to be a single species, while MORTENSEN (1943) concluded that they have to be maintained as distinct, even thought he recognized that "none of these characters are absolutely constant" (p. 108). The range of variation shown in the present collection leads us to suspect that *S. diadema* and *S. neumayeri* are synonymous. A decision should be delayed until complementary non-morphological (i.e. molecular) arguments could be added to the discussion.

Plexechinus planus (Mironov, 1978)

Urechinus planus Mironov, 1978 : 216, pl. 1 figs 7, 8, pl. 2 figs 1, 2, 5, 6, pl. 3 figs 2, 4, 9.

The specimens from the Epos III collection are similar to those collected off South Tasmania during the 16th cruise of the R/V "D.M. Mendeleyev" (Mironov, 1978). However, considering the characteristics of the Epos III specimens and Mironov's original description, it is preferable to refer the species to the genus *Plexechinus* instead of *Urechinus* (fig. 2). The genera of Urechinidae are primarily based on the simultaneous occurrence of a subanal fasciole and an anal snout, and on the supra- or inframarginal position of the periproct. In fact, this distinction is rather confusing. The characters used for the distinction participate to progressive ontogenetic changes and are part of a morphological continuum between small species (i.e. *Plexechinus* spp.) presenting an anal snout, a conspicuous fasciole and a supramarginal periproct, and larger species (*Urechinus* spp.) lacking anal snout and fasciole, and presenting an inframarginal periproct. The limits fixed for each genus are arbitrary and unreliable and should be reconsidered, taking into account features other than those directly involved in ontogeny. The architecture of the plastronal area provides a more accurate generic distinction. Adults of *Plexechinus* generally display a discontinuous interambulacrum 5 that is interrupted by a pair of ambulacral plates joining on the midline, and the labrum is elongated ;

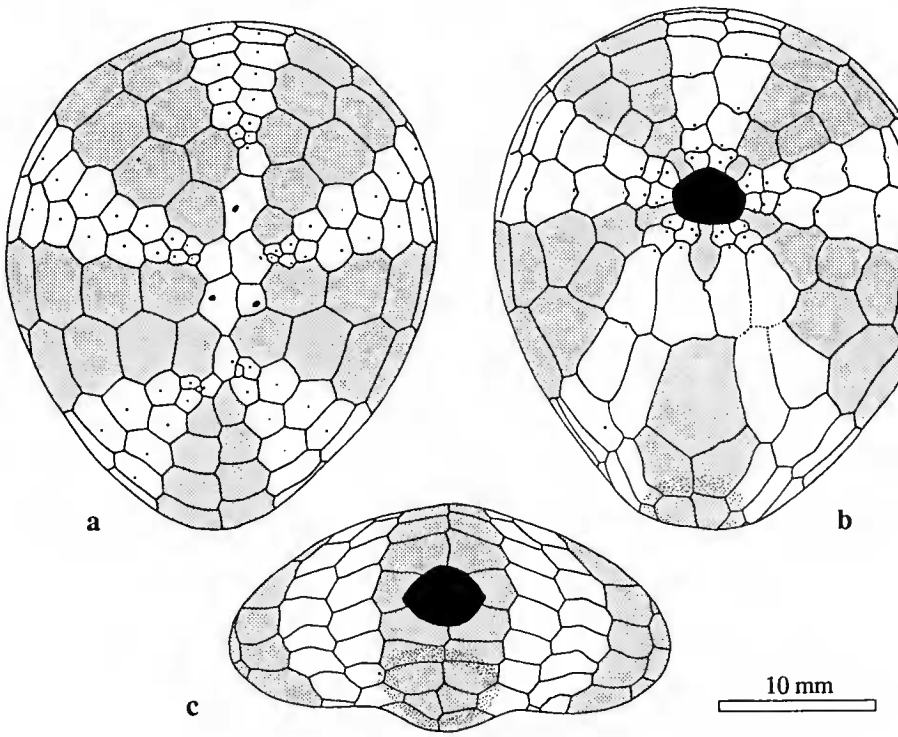

Fig. 2. — *Plexechinus planus*

occasionally interambulacrum 5 may be continuous, but with a narrow boundary between labrum and sternum (fig. 2b). *Urechinus* exhibits a classical plate pattern with a fully continuous interambulacrum 5. *U. aoteanus* McKnight (1976), reported as the only *Urechinus* species to present a discontinuous pattern, should be referred to *Plexechinus*. The tuberculation adds further arguments to this distinction : miliary tubercles form a regular dense coating, very apparent on the apical side in *Plexechinus*, while they are more scarcely distributed in *Urechinus*. Nevertheless even using these characters, the generic assignment remains ambiguous for some species, e.g. the brooding form *P. nordenskjoldi* (David & Mooi, 1990). Further large scale studies involving both ontogenetic and cladistic analyses are needed to clarify the relationships within the family.

Plexechinus aff. **cinctus** A. Agassiz, 1898

Plexechinus cinctus A. Agassiz, 1898 : 78, pl. 8 figs 3, 4; A. Agassiz, 1904 : 150, pl. 55 figs 3-5, pl. 58 figs 1-4, pl. 59, pl. 60 figs 1-3; Mortensen, 1950*b* : 119.

One broken specimen of MD03 from the Kerguelen region shows very puzzling characteristics and cannot be related with certainty to a known species. It is about 40 mm in length and its color is white purplish. Its general shape is elongated, with a triangularly grooved frontal ambulacrum resembling to some extent that of some extinct *Holaster*. A conspicuous subanal fasciole surrounds a smooth rostrum. The apical system is widely disjunct with separated bivium and trivium, and two gonopores open into a single genital plate. The interambulacrum 5 is interrupted by one pair of ambulacral plates between the labrum and the sternum. The miliary tuberculation forms a dense coating on the apical side. All those characters, excepts the sharp edged ambulacrum III, fit rather well the description of *P. cinctus*. This species is known only by two specimens from the Gulf of California at 1235 m depth, but it is the only one to which the MD03 specimen may be related although it has been found at a much shallower depth (585 m).

Pourtalesia aff. **hispida** A. Agassiz, 1879

Pourtalesia hispida A. Agassiz, 1879 : 204, pl. 205 figs 1-8, pl. 121 fig. 3; A. Agassiz, 1881 : 136, pl. 22 figs 6-19, pl. 39 figs 34, 36, pl. 41 figs 47, 48. Mortensen, 1950*b* : 149.

Specimens from Epos III resemble the two species of *Pourtalesia* which exhibit a short, but not elevated subanal rostrum (i.e. *P. aurorae* and *P. hispida*). Although they do not really fit either of these two species descriptions, they seem closer to *P. hispida* than to *P. aurorae*. The features shared with *P. hispida* are the vaulted lateral profile, the elongated general shape, and the serrated primary spines. On the other hand, the primary spines are not lined in regular horizontal rows and the ambital outline does not show parallel margins (they are curved as in *P. aurorae*). The position of the apex differs from the two above species; it is less anterior in the Epos III specimens. Owing to the relatively limited knowledge of the Antarctic species of *Pourtalesia* it is preferable to avoid describing a new species until more material becomes available (*P. aurorae* is based on 8 specimens described by Kœhler, 1926, and some fragments noted by Mironov, 1978; *P. hispida* is known from two type specimens, since destroyed,

described by A. AGASSIZ, 1879, and from the specimen described by KŒHLER, 1929). We refer the Epos III specimens to *P.* aff. *hispida*. The geographic distribution is rather different, the previously known specimens of *P. hispida* being reported from the South Indian Ocean (South Heard island).

Amphipneustes rostratus (Kœhler, 1926)

Antipneustes rostratus Kœhler, 1926 : 70, pl. 114 figs 1-6, pl. 115 figs 1, 3, 4, 6, pl. 116 figs 1-6, pl. 117 figs 1, 2, 6, 9, pl. 124 fig. 1.
Amphipneustes rostratus; MORTENSEN, 1951 : 268.

This species shows a wide range of individual variation and it was until now known only from a few specimens. *A. rostratus* is easily recognizable by its very large globiferous pedicellariae whose location remains detectable on naked tests by black spots. The posterior end of the test presents some variation as it may be vertically truncated with a marginal periproct, or rounded with an almost inframarginal periproct. The posterior interambulacrum may be depressed above the periproct. The ambital outline is usually more or less heart-shaped, but a few specimens have an almost oval ambitus. The sternum varies in width : it is wide and triangular in rounded specimens and narrow with parallel borders in more elongate specimens. The apical surface is covered by small tubercles densely distributed. Although *Amphipneustes* is characterized by the lack of fascioles, some of the Epos III *A. rostratus* may show a marginal fasciole, and one specimen has a short portion of a peripetalous fasciole.

Brachysternaster chesheri Larrain, 1985

Brachysternaster chesheri Larrain, 1985 : 121, figs 1-3.

The numerous specimens of *Brachysternaster* collected during Epos III expedition allow us to add some comments about the range of variation of this species. All the Epos III specimens fit closely to LARRAIN's description of the type and the two paratypes in the general shape of the test and the plate architecture. However, two "forms" can be distinguished : (1) large (ca. 75 mm in length) purplish specimens with scarce, evenly distributed primary tubercles; (2) smaller (ca. 55 mm in length) yellowish specimens with a more dense canopy of primaries. Both forms show on the apical side numerous scars which result from the loss of primary tubercles (similar to those observed in other irregular echinoids, DAVID & NÉRAUDEAU, 1989). Statistical comparisons of some shape parameters show no morphological differences between the two forms.

Parapneustes abatoides (Clark, 1925)
(Pl. V, 3-4)

Pericosmus abatoides H. L. Clark, 1925 : 199, pl. 11 figs 4-6.
Tripylus (*Parapneustes*) *abatoides*; MORTENSEN, 1951 : 279.

KŒHLER (1912*b*) created the genus *Parapneustes* for two new species, *P. cordatus* and *P. reductus*, without proposing a type species. On the basis of the two specimens available (i.e. the

two holotypes) KŒHLER noted that *P. cordatus* possesses only a peripetalous fasciole, while *P. reductus* possesses both a peripetalous and a marginal fasciole. CLARK (1925) described a new species, *Pericosmus abatoides*, which also possesses a peripetalous and a marginal fasciole. Later, he referred the species to the Schizasteridae, stating that "it is probably related to *Abatus* and will ultimately have to be made the type of a new genus" (1932 : 218). Finally, MORTENSEN (1951) studied specimens of *Parapneustes cordatus* collected by the "Discovery", and reported the occurrence of a latero-subanal fasciole (not observed by KŒHLER on the type specimen). He then referred *cordatus* to *Tripylus* (*Parapneustes*), restricting *Parapneustes* as a subgenus. He also placed KŒHLER's and CLARK's species (*reductus* and *abatoides*, respectively) in *Tripylus* (*Parapneustes*). He based his decision on a reinterpretation of the fascioles,

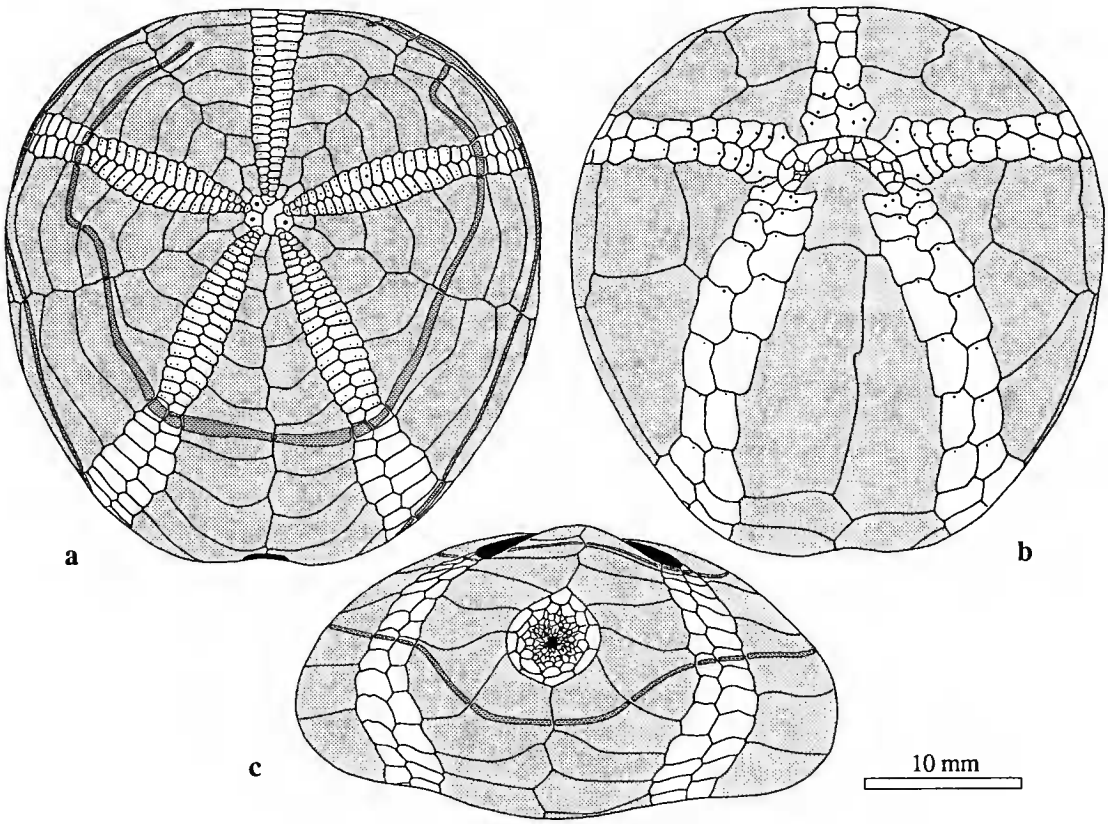

FIG. 3. — *Parapneustes abatoides*.

considering that both KŒHLER and CLARK's "marginal fasciole" was in fact the latero-subanal fasciole. MORTENSEN had drastically revised KŒHLER and CLARK's descriptions without having any specimen in hand. The Epos III specimens perfectly fit the species *P. abatoides* (fig. 3). They corroborate CLARK's description and cost doubt on MORTENSEN's interpretations. They possess a complete marginal fasciole and a peripetalous fasciole which

never crosses the anterior ambulacrum (fig. 3a). In some specimens, the peripetalous fasciole turns backwards for a more or less short distance, thus appearing double on the anterior interambulacra (a characteristic already quoted by CLARK). Similarly, the illustrations of the species *reductus* given by KŒHLER clearly show the presence of a marginal fasciole. Owing to these observations it is preferable to refer *reductus* and *abatoides* to *Parapneustes* and to retain *cordatus* in *Tripylus*. The proposed taxonomic position for *P. abatoides* is reinforced by the length of the latero-anterior petals, which reach the peripetalous fasciole. In complete revision of the brooding schizasterids, we would suggest that : (1) the genus *Parapneustes* is valid, and includes *P. abatoides* and *P. reductus*; (2) the genus *Tripylus* includes *T. cordatus, T. excavatus* and *T. beatriceae*; (3) the genus *Tripylus* could be close to *Abatus*, because of both possess a latero-subanal fasciole.

Delopatagus aff. **brucei** Kœhler, 1907

Delopatagus brucei Kœhler, 1907 : 147; KŒHLER, 1908 : 622, pl. 15 figs 130-135; MORTENSEN, 1950*b* : 252.

The morphological characters of the two broken specimens collected during the Epos III Expedition are those given by KŒHLER in 1908. The Epos III specimens show a minor difference — their latero-posterior petals are not shorter than the anterior ones. This is why we identify them as *D.* aff. *brucei*. Recent RNA-sequencing studies reveal that the Epos III specimens of *Delopatagus* are very close to *Amphipneustes* (Féral & Derelle, 1991). These data must be taken into account in reconsidering the taxonomic position of the genus *Delopatagus* as far as the Asterostomatidae constitutes an heterogenous polyphyletic group (FISHER, 1966). We suggest that *Delopatagus* belongs to the Schizasteridae, close to *Amphipneustes*. Like *Amphipneustes, Delopatagus* has no fascioles. Moreover, additional specimens held at the Smithsonian Institution (USNM E11063, E11274, E11275, E11286) have depressed petals that house juveniles. This indicates that *D. brucei* is a brooding species. This is strong evidence in supporting the idea that *Delopatagus* belongs in the Schizasteridae, the only brooding family in the spatangoids.

DISCUSSION

1. Geographical distribution

Two circumpolar regions, the Antarctic and the Subantarctic Regions are involved here. The Antarctic Region corresponds to an area extending from the shore of the Antarctic Continent to the Antarctic Convergence (fig. 4); it includes a large series of islands, namely, the South Shetlands, South Orkneys, the South Sandwich, South Georgia and Bouvet islands. As defined by PAWSON (1969), the Subantarctic Region covers a vast oceanic area south of the Subtropical Convergence (except that the limits of this region on the two sides of South America are not yet defined), and the shallow waters of the tip of South America (fig. 4); it includes Kerguelen, Heard and Macquarie Islands but not the southern of New Zealand although this lies within the limits of the Subtropical Convergence. Both regions are

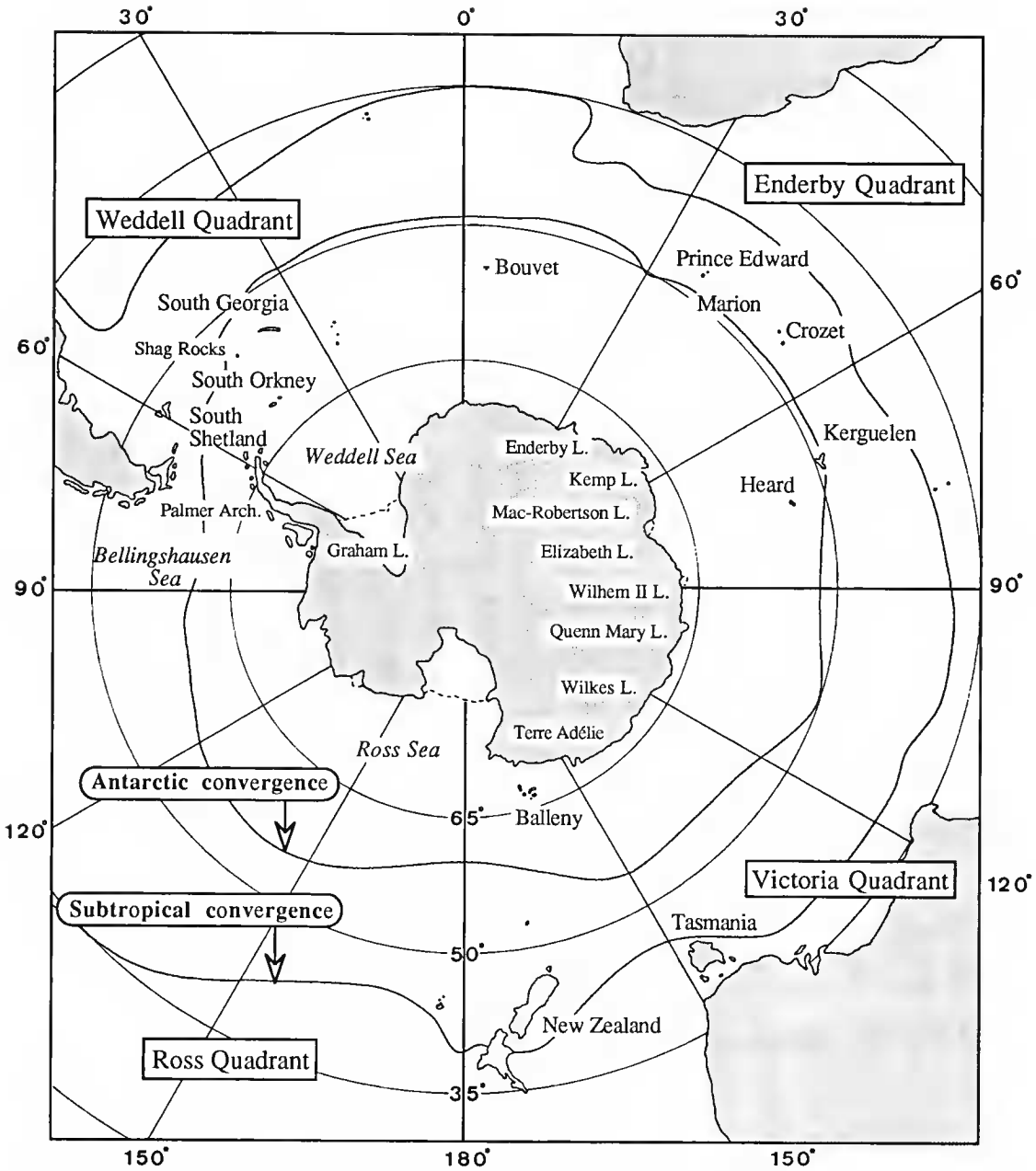

FIG. 4. — The Antarctic and Subantarctic regions and their biogeographical divisions (modified after PAWSON. 1969).

subdivided into four geographical quadrants : the Weddell, the Enderby, the Victoria and the Ross quadrants that respectively correspond to an American, an African, an Australian and a Pacific zone; these quadrants are identified for convenience; they have no biological significance. The biogeographic divisions used further in this discusion are those proposed by PAWSON (1969) : the Magellanic Subregion or Province, the Tristan da Cunha District and the Kerguelen Subregion or Province, for the Subantarctic region; the Continental or High Antarctic Subregion or Province, the extension of Continental Subregion of Province, the Scotia Subregion and the South Georgia District, for the Antarctic Region.

As already mentioned by PAWSON (1969) and by DELL (1972), over 50 families of echinoids are known but only six of them, namely, the Cidaridae, the Echinidae, the Arbaciidae, the Urechinidae, the Pourtalesiidae, and the Schizasteridae, occur in the Antarctic-Subantarctic Regions. A seventh family, the Echinothuriidae, can be added to this list, as specimens of *Kamptosoma asterias* were collected south of Heard Island during the MD03 Expedition. Very characteristic are the absence of the vast assemblage of regular non-cidaroid echinoids (apart from two genera, *Sterechinus* and *Kamptosoma*), and the diversity of two families, the Schizasteridae and the Cidaridae (within which all the Antarctic-Subantarctic species belong to one subfamily, the Ctenocidarinae) (PAWSON, 1969). The geographic distributions of the species collected are summarized in Table 6. There are several new range extensions. Wide latitudinal extensions, i.e., from one zone to another, are observed for five species : *Kamptosoma asterias* which extends from the Temperate to the Subantarctic Zone, *Ctenocidaris nutrix longispina, Urechinus wyvilli, Plexechinus planus*, and *Brisaster kerguelensis* which extend from the Subantarctic to the Antarctic Zone. Longitudinal extensions are observed within the Antarctic Zone, the Subantarctic Zone or both simultaneously. Within the Antarctic Zone, four species previously unreported in the Weddell Quadrant were collected in the Weddell Sea : *Amphipneustes rostratus* (known from the Victoria Quadrant), *Homalocidaris gigantea* (known from the Ross and the Victoria Quadrants), *Pourtalesia hispida* (known from the Victoria and Enderby Quadrants), *Amphipneustes bifidus* (known from the Enderby Quadrant), and *Parapneustes abatoides* (known from the Ross Quadrant). Nine other species (*Ctenocidaris speciosa, Notocidaris gaussensis, Notocidaris mortenseni, Sterechinus antarcticus, Plexechinus nordenskjoldi, Abatus cavernosus, Amphipneustes lorioli, Amphipneustes similis* and *Brachysternaster chesheri*), already reported in the Weddell Quadrant in the Bellingshausen Sea or along the Antarctic peninsula are now known to occur in the east part of the Weddell Sea. Within the Subantarctic Zone, two species extend longitudinally : in the Enderby Quadrant, *Brisaster kerguelensis*, known from Kerguelen and Bouvet Islands, reaches the Crozet and Heard Islands; *Tripylaster philippi*, known in the Weddell Quadrant, extends to the Enderby Quadrant (Marion and Prince Edward Islands). One species, *Sterechinus neumayeri*, known in both Antarctic and Subantarctic Zones from three Quadrants extends in both Zones simultaneously to the fourth Quadrant (Enderby Quadrant).

TABLE 6. — Geographical distribution of the collected species (expanded areas, corresponding to this paper, are in bold-fact types).

SPECIES	Antarctic (AZ), Subantarctic (SAZ) or Temperate (TZ) zones	LOCALITIES (W.Q. = Weddel quadrant, E.Q. = Enderby quadrant V.Q. = Victoria quadrant, R.Q. = Ross quadrant)	DATA SOURCES
Aporocidaris antarctica	SAZ + AZ	E.Q. + V.Q. (off Elizabeth to Queen Mary Lands, Kerguelen Isl.)	BELL 1908, 1917; KŒHLER 1912*a, b*; MORTENSEN 1928*b*; PAWSON 1969
Ctenocidaris nutrix	SAZ + AZ	E.Q. (off Antarctic coast, Kerguelen, Crozet, Heard Isl.)	AGASSIZ 1881; DÖDERLEIN 1903-06; GUILLE 1977*b*; KŒHLER, 1912 *a, b.* 1917; MORTENSEN 1903, 1909, 1928*b*; PAWSON, 1969; STUDER 1876, 1880; WYV. THOMPSON 1876, 1877
Ctenocidaris nutrix longispina	SAZ	E.Q. (Heard Isl.) + **W.Q. (Weddel Sea)**	MORTENSEN 1928*a, b*
Ctenocidaris perrieri	AZ	W.Q. (South Shetlands Isl., Palmer Arch.,Bellingshausen Sea, Weddell Sea) + V.Q. (Balleny Isl.) + R.Q. (Ross Sea)	BELL 1908, 1917; KŒHLER 1912*a, b*; MORTENSEN 1925, 1928*b*; PAWSON, 1969; FELL 1976
Ctenocidaris speciosa	SAZ + AZ	V.Q. (Coulman, Balleny Isl.) + W.Q. (off Graham Land, Palmer Arch., South Georgia South Orkneys, South Shetlands Isl., Shag Rocks, off Tierra del Fuego, **Weddell Sea)**	BERNASCONI 1953; KŒHLER 1926; MORTENSEN 1910, 1928*a, b*, 1936; PAWSON 1969; FELL 1976
Ctenocidaris spinosa	AZ	V.Q. (off Queen Mary Land) + W.Q. (Weddell Sea)	KŒHLER 1926; MORTENSEN 1928*b*; PAWSON 1969; FELL 1976
Homalocidaris gigantea	AZ	R.Q. (Ross Sea) + V.Q. (off Victoria Land) + **W.Q. (Weddel Sea)**	CLARK 1925; MC KNIGHT 1976; MORTENSEN 1928*b*, 1950*a*; PAWSON 1969
Notocidaris gaussensis	AZ	R.Q. + W.Q. (South Shetlands Isl., Bellingshausen Sea, **Weddell Sea)**	KŒHLER 1912*b*; MORTENSEN 1909, 1928*b*, 1950*a*; PAWSON 1969; FELL 1976
Notocidaris mortenseni	AZ	E.Q. (off Kemp Land to Wilhem II Land) + W.Q. (South Shetlands Isl., **Weddell Sea)**	BERNASCONI 1953; DÖDERLEIN 1903-06; KŒHLER 1900, 1901; MORTENSEN 1909, 1928*b*; PAWSON 1969; FELL 1976
Kamptosoma asterias	TZ + AZ	off coast of Chile (33°31′S) + **E.Q. (South Heard Isl.)**	A. AGASSIZ 1881, 1904; MORTENSEN 1903, 1935
Sterechinus agassizi	SAZ + AZ	W.Q. (South Georgia, Falklands Isl.), South Atlantic (American coast up to 46°14′S)	AGASSIZ 1872-74; BERNASCONI 1953; KŒHLER 1912*b*, MEISSNER 1900; MORTENSEN 1909, 1943; PAWSON 1969

Sterechinus antarcticus	AZ	W.Q. (South Georgia, South Shetlands Isl., Palmer Arch., off Graham Land, **Weddell Sea**) + V.Q. (Balleny Isl.) + E.Q. (Kemp Land to Mac-Robertson Land)	BERNASCONI 1953; KŒHLER 1901, 1912*b*, 1926; MC KNIGHT 1976; MORTENSEN 1903, 1909, 1936, 1943, 1950*a*; PAWSON 1969
Sterechinus neumayeri	SAZ + AZ	V.Q. (off Terre Adélie, Balleny Isl.) + W.Q. (Palmer Arch., South Orkneys, South Shetlands, South Georgia, South Patagonia Isl.) + R.Q. (Ross Sea) + **E.Q. (Prince Edward, Marion, Crozet, Kerguelen Isl.)**	ARNAUD 1965; BERNASCONI 1953; DÖDERLEIN 1903-06; GRIEG 1929*a, b*; KŒHLER 1908, 1912b, 1926; MC KNIGHT 1976; MORTENSEN 1903, 1909, 1910, 1925, 1936, 1943, 1950*a*; PAWSON 1969
Plexechinus planus	SAZ + AZ	V.Q. (44°06′ S-145°56′ E) + **W.Q. (Weddell Sea)**	MIRONOV 1978
Plexechinus nordenskjoldi	AZ	E.Q. (off Enderby to Mac-Robertson Lands) W.Q. (South Georgia Isl., Antarctic, **Weddell Sea**)	BERNASCONI 1953; KŒHLER 1912*b*; MORTENSEN 1905, 1909, 1910, 1936, 1950*a*
Urechinus wyvilli	SAZ + AZ	Subantarctic Sea (E.Q., V.Q., R.Q., W.Q.) + off Pacific coast of Chile (up to 33° S) + **W.Q. (Weddell Sea)**	A. AGASSIZ 1879, 1881; KŒHLER 1908; MORTENSEN 1907, 1909, 1950*b*; USNM collections
Urechinus mortenseni	AZ	W.Q. (off Graham Land)	DAVID & MOOI 1990
Pourtalesia hispida	SAZ + AZ	E.Q. (extreme South of Indian ocean) + V.Q. (off Queen Mary Land) + **W.Q. (Weddell Sea)**	A. AGASSIZ 1881; KŒHLER 1912*b*, 1926; MORTENSEN 1907, 1909, 1950*b*
Abatus cavernosus	SAZ + AZ	W.Q. (South America 36° S to South Georgia, Palmer Arch., **Weddell Sea**) + V.Q. Terre Adélie) + E.Q. (Kerguelen Isl., Heard Isl.)	AGASSIZ 1881; BERNASCONI 1953; DÖDERLEIN 1903-06; GRIEG 1929*a, b*, KŒHLER 1908, 1912b, 1926; MEISSNER 1900; Mortensen 1909, 1910, 1936, 1950*a*, 1951; PAWSON 1969; PHILIPPI 1845; STUDER 1876, 1880
Abatus cordatus	SAZ	E.Q. (Kerguelen Isl.)	A. AGASSIZ 1881; CHERBONNIER & GUILLE 1975; DÖDERLEIN 1903-06; GUILLE 1977*b*; KŒHLER 1912*b*, 1917; MORTENSEN 1909, I936, 1950*a*, 1951; PAWSON 1969; SMITH 1879; STUDER 1876, 1880; VERRILL 1876
Amphipneustes bifidus	AZ	E.Q. (Enderby Land, Kemp Land) + **W.Q. (Weddell Sea)**	MORTENSEN 1950*a*; PAWSON 1969
Amphipneustes lorioli	AZ	W.Q. (Palmer Arch., Bellingshausen Sea, **Weddell Sea**) + V.Q. (between Queen Mary and Wilkes Lands)	BERNASCONI 1953; KŒHLER 1900, 1901, 1912*a, b*; MORTENSEN 1909, 1910, 1936, 1950*a*, 1951; PAWSON 1969

Amphipneustes rostratus	AZ	V.Q. (off Queen Mary Land to Terre Adélie) + **W.Q. (Weddell Sea)**	MORTENSEN 1951; PAWSON 1969
Amphipneustes similis	AZ	W.Q. (Palmer Arch., **Weddell Sea**)	BERNASCONI 1953; MORTENSEN 1936, 1951; PAWSON 1969
Brachysternaster chesheri	AZ	W.Q. (South Shetlands Isl., **Weddell Sea**)	LARRAIN 1985
Brisaster kerguelensis	SAZ + AZ	E.Q. (Kerguelen, Bouvet, **Crozet, Heard Isl.**)	DÖDERLEIN 1903-06; MORTENSEN 1950*a*, 1951; PAWSON 1969
Delopatagus brucei	AZ	W.Q. (South Georgia Isl., **Weddell Sea**)	KŒHLER 1907, 1908, 1912*b*; MORTENSEN 1909, 1950*b*
Parapneustes abatoides	AZ	R.Q. (Ross Sea) + **W.Q. (Weddell Sea)**	CLARK 1925; MORTENSEN 1951
Tripylaster philippi	SAZ + AZ	South America 35°S (Rio de la Plata) to the Fuegian coast + W.Q. (South Georgia Isl.) + **E.Q. (Prince Edward, Marion Isl.)**	BERNASCONI 1953; DÖDERLEIN 1903-06; KŒHLER 1912*b*; MEISSNER 1900; MORTENSEN 1907, 1909, 1910, 1936, 1951, 1952; PAWSON 1969; STUDER 1880

Three major patterns of distribution can now be identified among the echinoid genera :

1 — A circumpolar distribution in the Antarctic Zone only for six genera (*Homalocidaris, Notocidaris, Amphipneustes, Brachysternaster, Parapneustes, Delopatagus*).

2 — A Circumpolar distribution in the Antarctic Zone, but with representatives in the Magellanic and in the Kerguelen Provinces (*Ctenocidaris, Sterechinus*), or with representatives in the above mentioned Provinces and in the southern coastal waters of America for two other genera (*Abatus* which occurs up to 36° S off Argentina, and *Tripylaster* which occurs up to 41°50 S off Chile and up to 35° S off Argentina).

3 — A circumpolar distribution in the Antarctic and Subantarctic Zones with representatives in more northern areas : five genera (*Aporocidaris, Brisaster, Pourtalesia, Plexechinus, Urechinus*. These four last genera are deep-sea forms).

A deep-sea occurrence in the Subantarctic Zone is observed for *Kamptosoma*, a genus already known from more northern areas.

According to PAWSON (1969), fifteen genera (*Ctenocidaris, Rhynchocidaris, Homalocidaris, Aporocidaris, Notocidaris, Sterechinus, Abatus, Amphipneustes, Brisaster, Tripylus, Tripylaster, Delopatagus, Urechinus, Pourtalesia* and *Plexechinus*) have been collected in the Antarctic Zone. The total is now seventeen genera, with *Brachysternaster* described in 1985 by LARRAIN and with *Parapneustes* revalidated in the present work. Two of the genera mentioned by PAWSON (1969), i.e. *Rhynchocidaris* and *Tripylus*, were not collected during the expeditions reported here. Of the seventeen genera now known to occur in the Antarctic Zone, seven (see pattern 1 + *Rhynchocidaris*) are restricted to the Antarctic Zone, five (see pattern 2 + *Tripylus*) are restricted to the Antarctic-Subantarctic Zones and five occur elsewhere in the world. The proportion of endemic genera in the Antarctic Zone calculated from our data is higher than that mentioned by DELL (1972) (41 % versus 25 %).

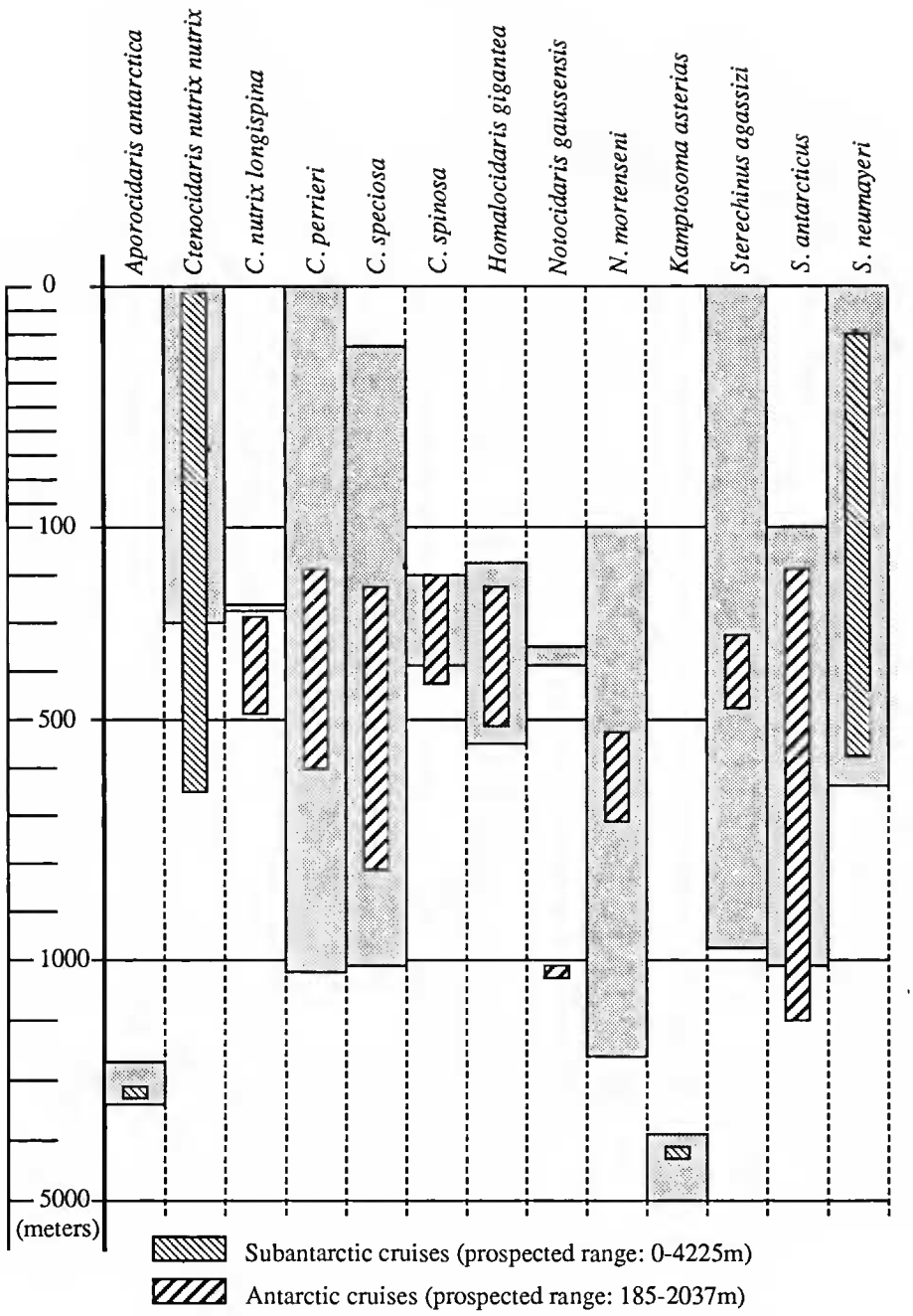

FIG. 5. — Bathymetrical distribution of the collected species (regular echinoids).

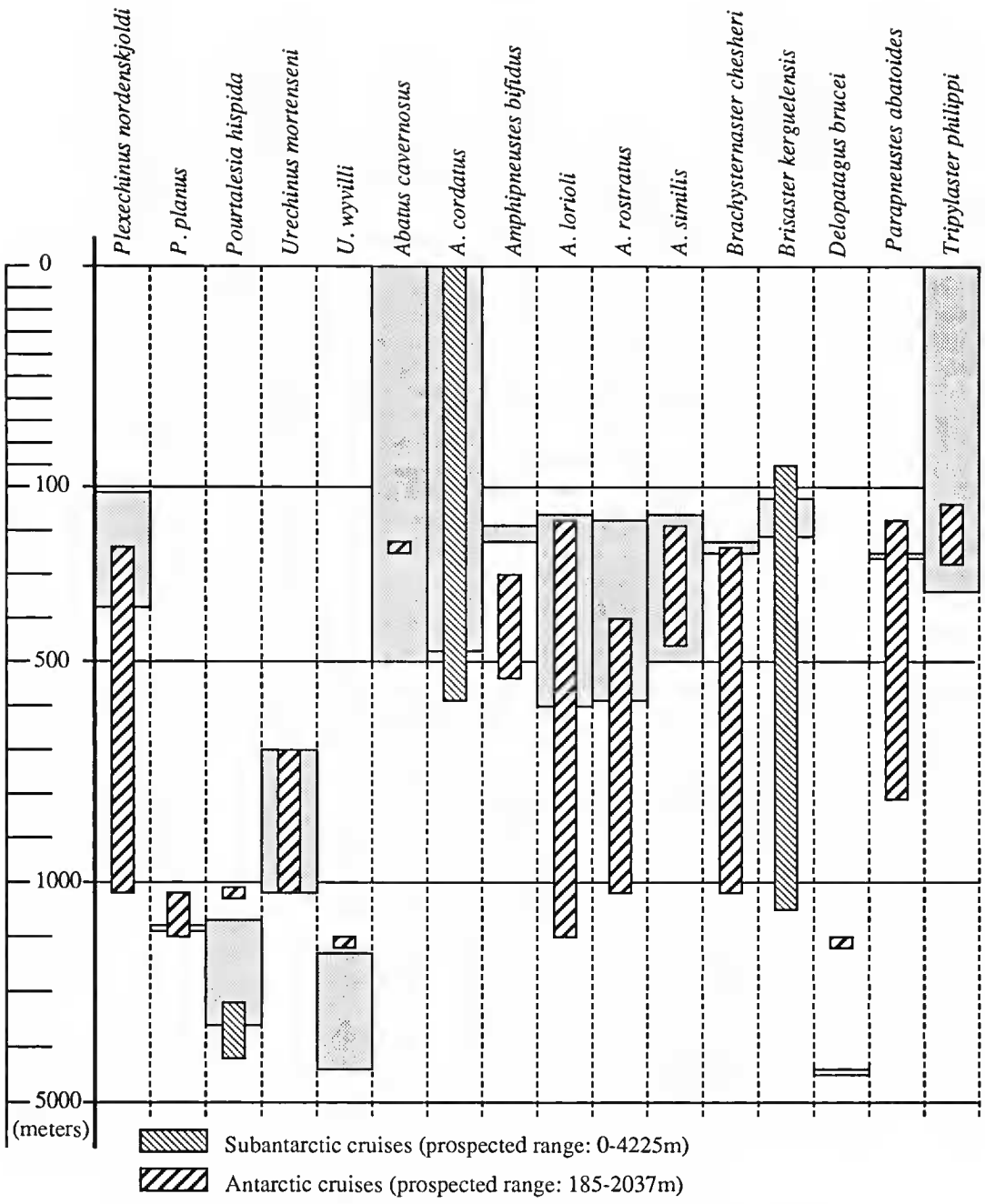

FIG. 6. — Bathymetrical distribution of the collected species (irregular echinoids).

2. Bathymetrical distribution

The continental shelf around Antarctica is narrow, except in the two embayments of the Ross Sea and the Weddell Sea (DELL, 1972). Its outer limit generally lies between 400 and 600 m deep, but it reaches 800 m in the Ross Sea. The continental slope ends at depths of 3000 m. From there three main basins are arranged around the continent : an Atlantic-Indian-Antarctic basin, an Eastern Indian-Antarctic basin and a Pacific-Antarctic basin. The northern limits of each basin correspond to major ridges (crests located at depths less than 3000 m) arranged in a more or less circumpolar fashion (DELL, 1972). Figures 5 and 6 summarize the bathymetrical distribution of the species collected and displays a comparison between the previously known bathymetric distributions and the distributions recorded in the present work. We can expand downward the bathymetric range of several species. Two species (*Ctenocidaris nutrix longispina*, and *Amphipneustes bifidus*) reach the outer edge of the continental shelf in the Weddell Sea. Two other species reach the epibathyal zone (*Ctenocidaris nutrix nutrix* in the Kerguelen area, and *Parapneustes abatoides* in the Weddell Sea). The range of five species is expanded from the continental shell to the bathyal zone : *Notocidaris gaussensis, Plexechinus nordenskjoldi, Amphipneustes rostratus*, and *Brachysternaster chesheri* in the Weddell Sea ; *Brisaster kerguelensis* from the MD expeditions. One species, *Amphipneustes lorioli*, previously known to occur down to 600 m, reaches more than 2000 m in the Weddell Sea.

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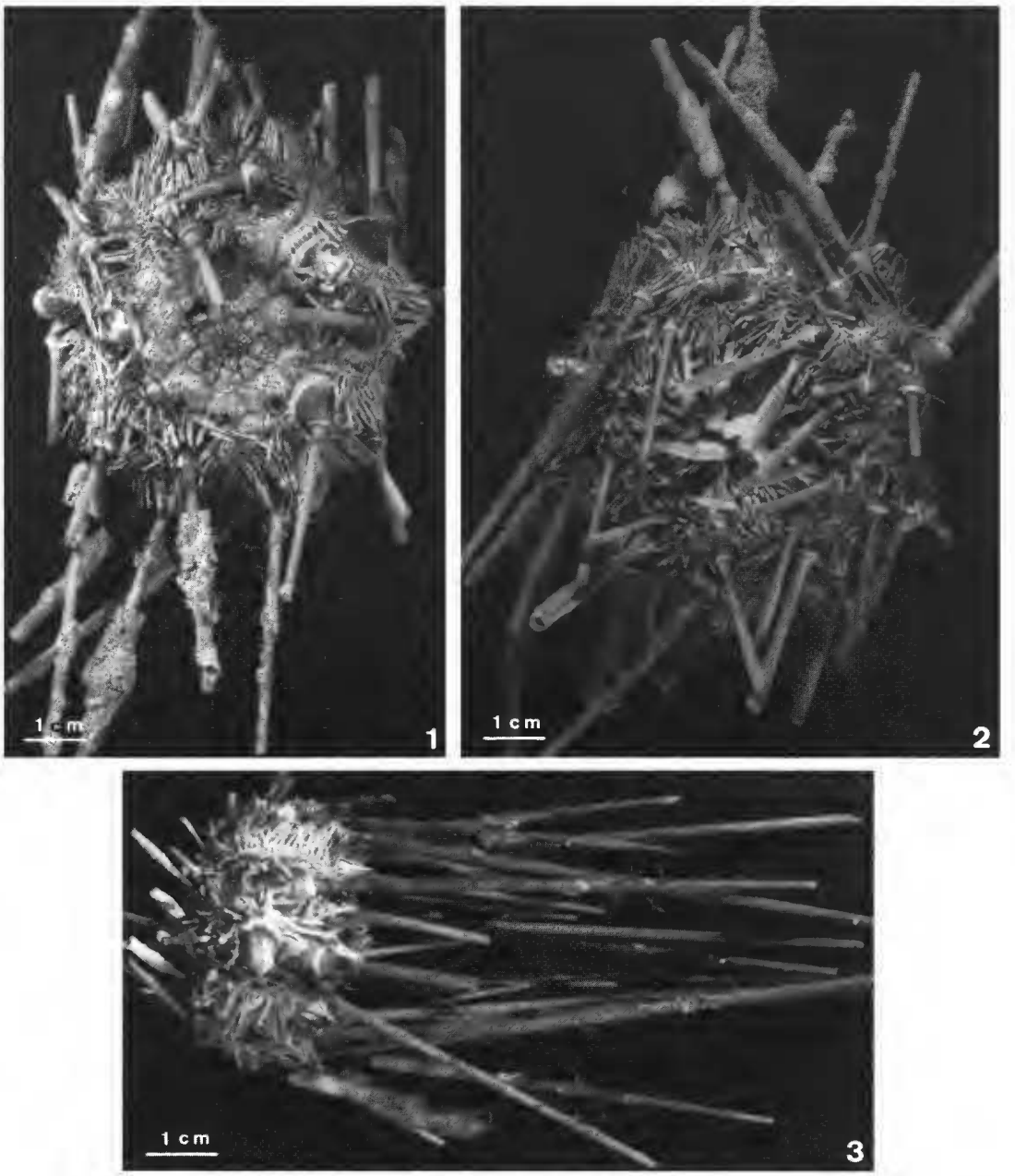

PLATE I. — *Ctenocidaris nutrix longispina* : apical view (1), oral view (2), lateral view (3).

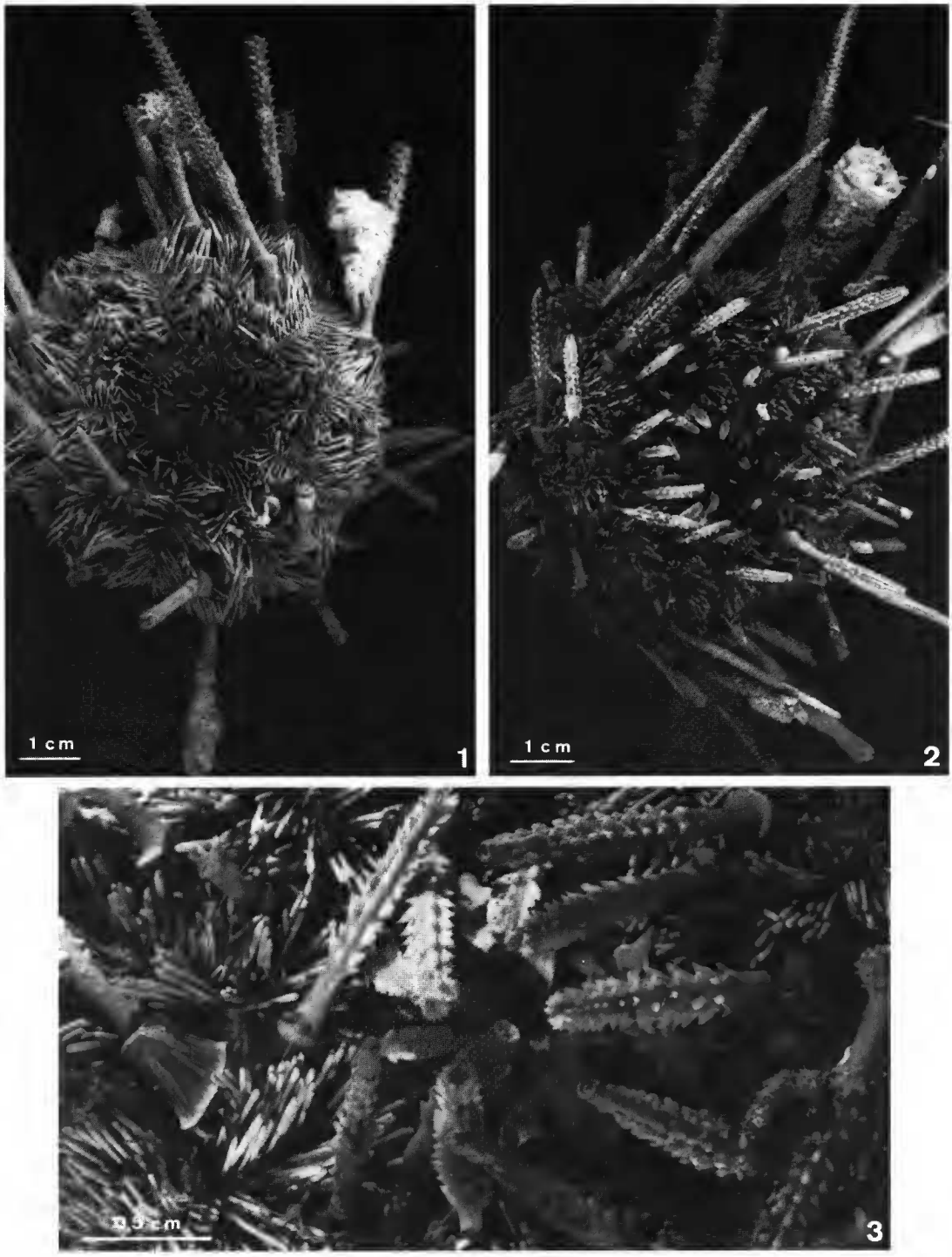

PLATE II. — *Ctenocidaris perrieri* : apical view (1), oral view (2), peri-oral area (3).

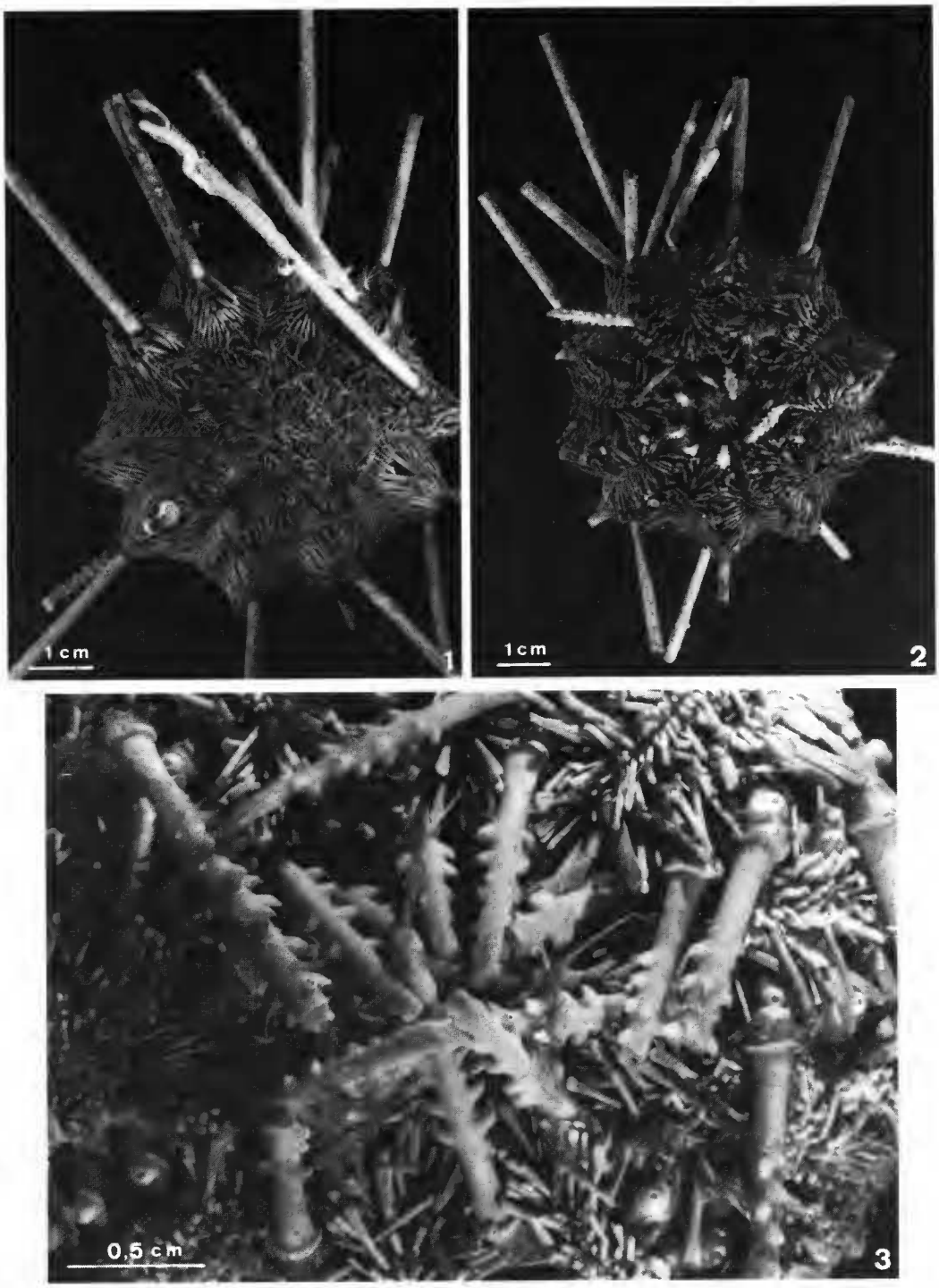

PLATE III. — *Ctenocidaris speciosa* : apical view (1), oral view (2), peri-oral area (3).

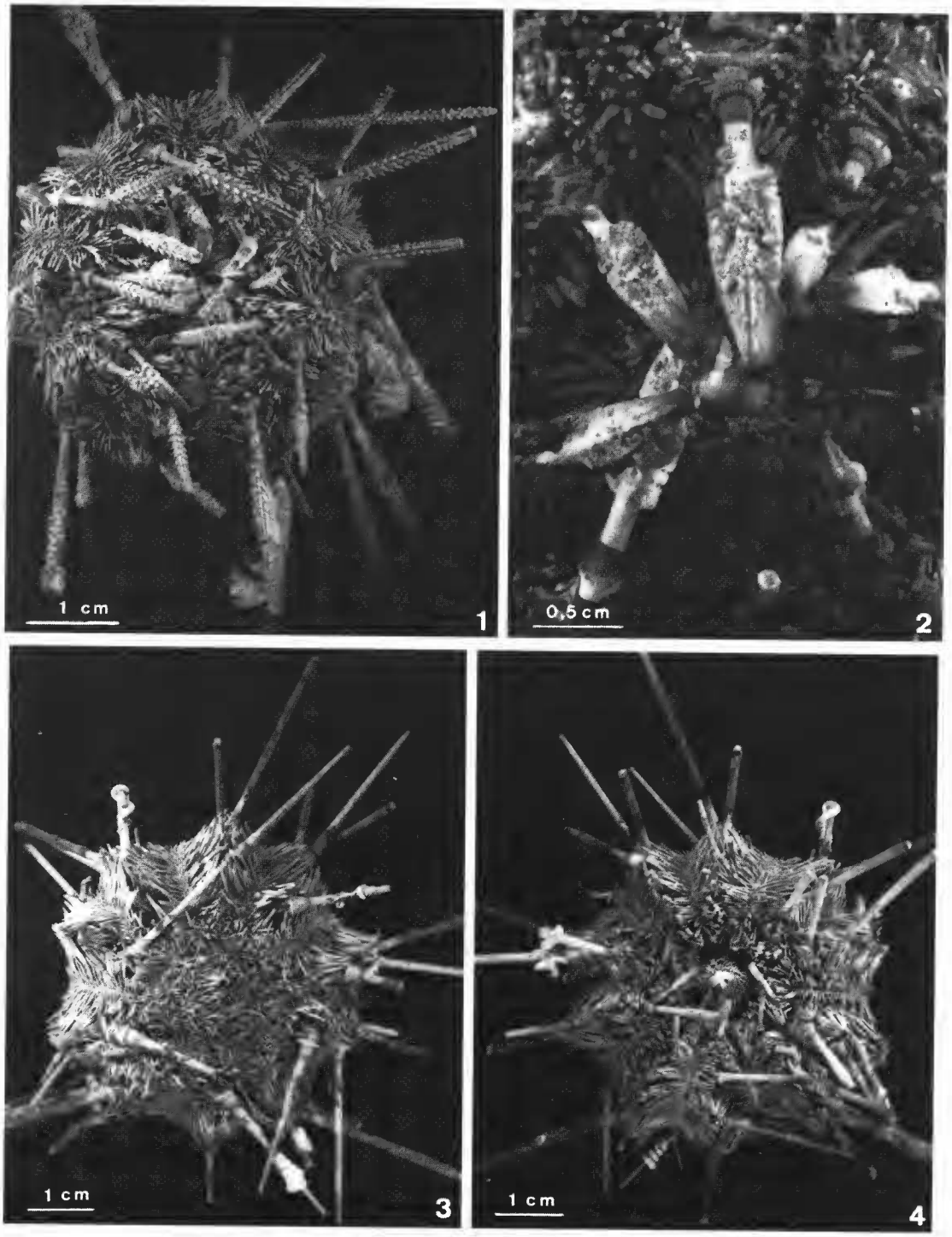

PLATE IV. — *Ctenocidaris spinosa* ; oral view (1), peri-oral area (2). *Homalocidaris gigantea* : apical view (3), oral view (4)).

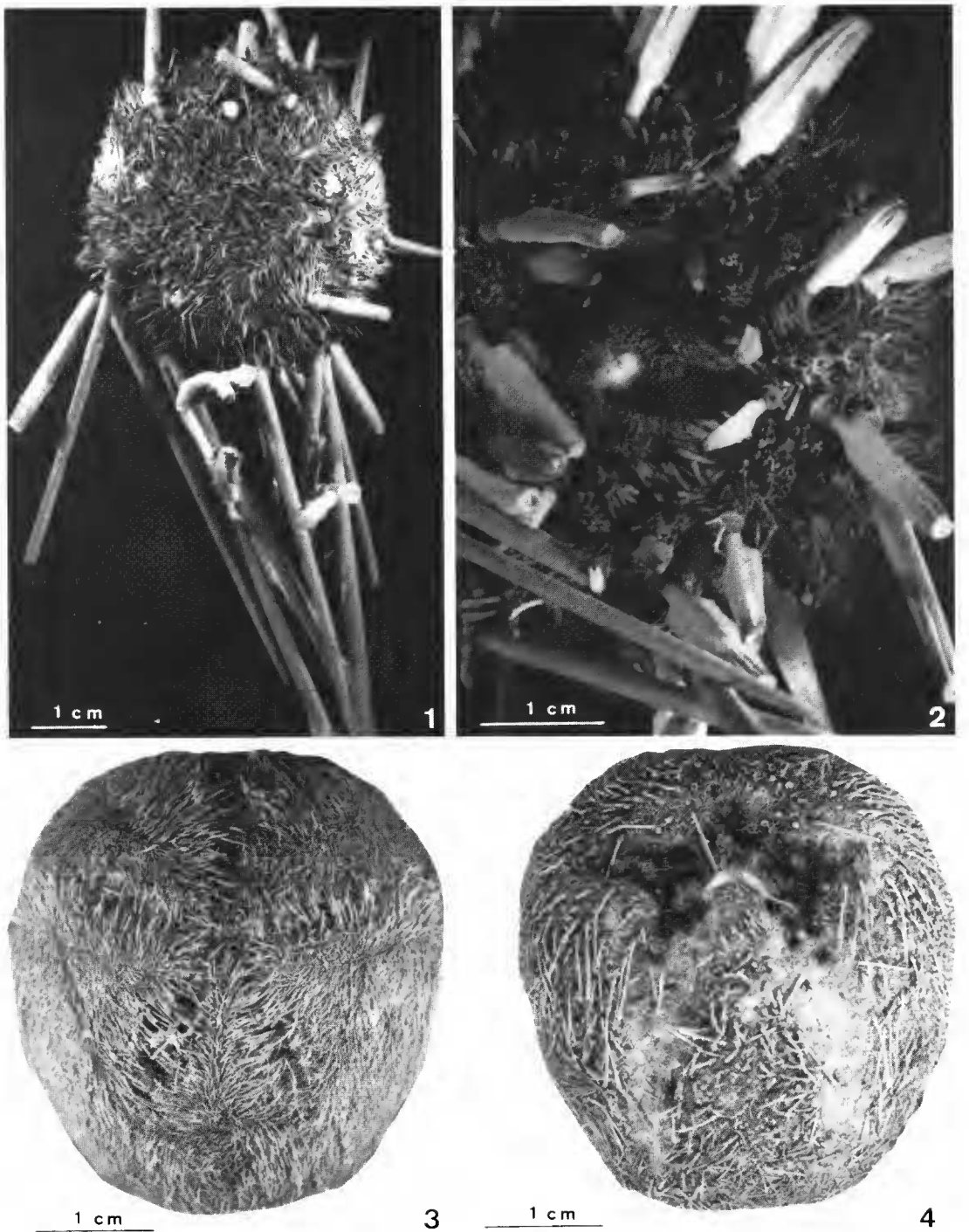

PLATE V. — *Notocidaris gaussensis* : apical view (1), peri-oral area (2). *Parapneustes abatoides* : apical view (3), oral view (4).